

November 2002

# **Proposed Restrictions on Snowmobile Riding in the Greater Yellowstone Area Under the Delay Rule**

## **Draft Report**

Prepared for

**National Park Service  
Environmental Quality Division**

**Dr. Bruce Peacock**

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Fort Collins, CO 80525

Prepared by

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# 1

## Introduction

This report provides an economic analysis of the impacts of delaying implementation of the 2001 regulation for one year to allow sufficient time for completion of the SEIS and preparation of a new record of decision.

The National Park Service (NPS) has been assessing winter use issues within the parks located in the Greater Yellowstone Area (GYA) [Yellowstone National Park (YNP), Grand Teton National Park (GTNP), and the John D. Rockefeller, Jr., Memorial Parkway (the Parkway)] for several decades. This assessment has resulted in intensive study and public involvement, and in 1990 a Winter Use Plan (NPS, 1990) was completed for GYA. In 1997, the Fund for Animals filed suit against NPS alleging that NPS had failed to conduct adequate analysis under the National Environmental Policy Act (NEPA) when developing its winter use plan for the areas, failed to consult with the U.S. Fish and Wildlife Service on the effects of winter use on threatened and endangered species, and failed to evaluate the effects of trail grooming on wildlife and other park resources. In 1997, the Department of the Interior (DOI) and the plaintiffs reached a settlement agreement in which NPS agreed to produce an environmental impact statement (EIS). The final environmental impact statement (FEIS) was published and the record of decision (ROD) was subsequently signed on November 22, 2000. The new rule was published in the *Code of Federal Regulations* (CFR) on January 22, 2001 (36 CFR Part 7).<sup>1</sup> The regulation eliminated recreational snowmobile and snowplane use from the parks by the winter of 2003–2004.

On December 6, 2000, a lawsuit filed by the International Snowmobile Manufacturers Association (ISMA) asked for the pending decision, reflected in the ROD and final rule, to be set aside on the basis of NEPA process infractions. The Office of the Secretary of the Interior negotiated a procedural settlement that

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<sup>1</sup>The rule became effective February 21, 2001.

became final on June 29, 2001. As provided in that settlement agreement, NPS is acting as lead agency to prepare a supplemental environmental impact statement (SEIS), and the State of Wyoming was added as a cooperating agency.<sup>2</sup> In accordance with the settlement, the SEIS will incorporate new or additional information and data, as provided by the affected public and cooperating agencies, including information regarding new snowmobile technologies, submitted with respect to a winter use plan for the parks. A Notice of Intent to prepare an SEIS was published in the *Federal Register* on July 27, 2001 (66FR39197). The Draft SEIS was released for public comment on March 29, 2002.

The purpose of the proposed rule (the “delay rule”) is to delay implementation of the existing snowmobile regulations in YNP, GTNP, and the Parkway for one year to allow sufficient time for completing the SEIS and preparing a new ROD.

This report describes the results of the analysis of the economic impacts of delaying implementation of the rule, as amended on January 22, 2001, for one year. For this delay rule to be implemented, federal statutes, including Executive Order 12866, require NPS to conduct a benefit-cost analysis of the proposed regulation and an analysis of the impact of the regulation on small businesses under the Regulatory Flexibility Act (RFA) of 1980. Following a description of the current and proposed regulations, this report presents baseline information about all portions of the GYA and the current status of snowmobile activity. For the purposes of evaluating the effect of the delay rule, the baseline was considered the current rule published in the *Federal Register* in January 2001. From this baseline, benefit-cost and small business impact analyses were conducted to determine the impacts of delaying implementation of the rule for one year. Benefit-cost and regulatory flexibility analyses in support of the January 2001 rulemaking provide additional background for the analysis provided in this report (NPS, 2001).

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<sup>2</sup>Subsequent to the settlement, all agencies (other than the State of Wyoming) that signed cooperating agency agreements during the earlier EIS process agreed to be cooperating agencies for the SEIS, and include the U.S. Forest Service, the States of Montana and Idaho, Fremont County in Idaho, Gallatin and Park Counties in Montana, and Park and Teton Counties in Wyoming. In addition, the Environmental Protection Agency (EPA) was added as new cooperating agency.

## 1.1 ORGANIZATION OF REPORT

This report is organized as follows. Section 1 describes the reason for the regulation and the current and proposed regulations in YNP, GTNP, and the Parkway. Baseline visitation, environmental conditions, and economic activity in these parks are described in Section 2. Section 3 describes the methodology for assessing the impacts of the alternatives on social welfare and presents a cost-benefit analysis of the regulation. Section 4 provides an analysis of the regulatory alternatives' impacts on small businesses. In addition, Appendix A includes a detailed theoretical discussion of the types of benefits and costs associated with snowmobile restrictions in national parks and the methods used in their estimation.

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## 1.2 PROBLEM ADDRESSED BY REGULATION

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*In general, regulations should be imposed only where a market failure exists that cannot be resolved efficiently by measures other than federal regulation. The justification for restricting snowmobile use in national parks is based on externalities associated with their use.*

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The U.S. Office of Management and Budget (OMB) directs regulatory agencies to demonstrate the need for their rules (OMB, 1992). In general, regulations should be imposed only where a market failure exists that cannot be resolved efficiently by measures other than federal regulation. If each producer and consumer has complete information on his or her actions and makes decisions based on the full costs of those actions, resources will be allocated in a socially efficient manner. However, when the market's allocation of resources diverges from socially optimal values, a market failure exists. A defining feature of a market failure is the inequality between the social consequences of an action and a purely private perception of benefits and costs. The major causes of market failure identified in the Office of Management and Budget guidance on Executive Order 12866 are externalities, natural monopolies, market power, and inadequate or asymmetric information. For environmental problems resulting from market failures, this divergence between private and social perspectives is normally referred to as an externality. Such divergences occur when the actions of one economic entity impose costs on parties that are external to, or not accounted for in, a market transaction or activity.

The justification for restricting snowmobile use in national parks is based on externalities associated with their use. For instance, the

operation of snowmobiles imposes costs on society associated with noise emissions, air pollution emissions, and health and safety risks. Because snowmobile users have little incentive to consider these external costs, they are likely to make decisions about their snowmobile use without taking these impacts on other people into account.

If these externalities are internalized to the snowmobile users generating them, the problem can be mitigated. For example, if snowmobilers were required to pay for the marginal external costs they impose on others, they would begin to take those costs into account when making decisions, and the market failure would be corrected. However, accurately assigning costs associated with each individual snowmobiler's actions and enforcing payment is essentially infeasible at this time. Other regulatory options to address the externalities associated with snowmobile use are far easier to implement and enforce. Some of the potential options include geographic restrictions, time-of-use restrictions, and restrictions on snowmobile engine type.

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*The extent to which social welfare improves due to snowmobile regulation depends on the relative costs and benefits associated with such restrictions. While non-snowmobilers gain, the snowmobilers and local businesses that serve them experience welfare losses.*

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The extent to which social welfare improves due to snowmobile regulation depends on the relative costs and benefits associated with such restrictions. While non-snowmobilers may gain from restrictions, the snowmobilers and local businesses that serve them experience welfare losses. Thus, whether a particular regulatory option will improve social welfare is dependent on numerous factors that influence the level of costs and benefits.

Based on earlier analysis, NPS decided that snowmobiles should be banned from YNP, GTNP, and the Parkway and published a rule that would eliminate recreational snowmobile and snowplane use in the parks by the winter of 2003–2004. However, NPS is now in the process of revisiting this decision in light of additional information gathered as part of the SEIS. To allow time to prepare and evaluate the SEIS, NPS is delaying the implementation of the January 2001 regulation for one year. Delaying the implementation of the rule does not directly address the externalities associated with snowmobile use in the GYA parks. Instead, it allows time for more complete information to be used in developing snowmobile regulations for YNP, GTNP, and the Parkway, which may lead to a more efficient approach to mitigating the externalities.

## 1.3 CURRENT SNOWMOBILE REGULATIONS

The regulations governing snowmobile use in the three GYA national parks, resulting from the amendments published to 36 CFR Part 7 in the *Federal Register* on January 22, 2001, are detailed in Sections 1.3.1 through 1.3.3.

### 1.3.1 Yellowstone National Park

The current snowmobile regulations for YNP are as follows:

#### §7.13 Yellowstone National Park

- (l)(1) *May I operate a snowmobile in YNP?* You may operate a snowmobile in YNP in compliance with the public use limits and operating conditions established in this section. Effective with the end of the winter use season of 2002–2003,<sup>3</sup> snowmobile use in YNP is prohibited, except for essential administrative use and in emergency situations as determined by the Superintendent.
- (l)(2) *What routes are designated for snowmobile use in the park through the winter season of 2001–2002?* Effective until the end of the winter use season of 2001–2002, snowmobile use is limited to the unplowed roadway, which is defined as that portion of the roadway located between the road shoulders designated by snow poles or poles, ropes, and signs erected by the Superintendent to regulate snowmobile activity, of the following routes for snowmobile use:
  - (i) The Grand Loop Road from its junction with Terrance Springs Drive to Norris Junction.
  - (ii) Norris Junction to Canyon Road.
  - (iii) The Virginia Cascade Drive.
  - (iv) The Grand Loop Road from Norris Junction to Madison Junction.
  - (v) The West Entrance Road from the park boundary at West Yellowstone to Madison Junction.
  - (vi) The Grand Loop Road from Madison Junction to West Thumb.
  - (vii) The Firehole Canyon Drive.
  - (viii) The Blacktail Plateau Drive.
  - (ix) The Fountain Flat Drive.

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<sup>3</sup>There is a typographical error in the CFR incorrectly indicating that snowmobiles would be permitted until the end of the 2003–2004 season; however, the intent of the rule is that snowmobiles will be permitted until the end of the 2002–2003 season.

- (x) The South Entrance Road from the south entrance to West Thumb.
  - (xi) The Grand Loop Road from West Thumb to its junction with the East Entrance Road.
  - (xii) The East Entrance Road from the east entrance to its junction with the Grand Loop Road.
  - (xiii) The Grand Loop Road from its junction with the East Entrance Road to Canyon Junction.
  - (xiv) The Canyon Rim Drives.
  - (xv) The Grand Loop Road from Canyon Junction to Tower Junction.
  - (xvi) In the developed areas of Madison Junction, Old Faithful, Grant Village, Lake Village, Fishing Bridge, Canyon and Norris Junction, snowmobile routes to scenic points of interest, lodging, and other facilities will be designated by appropriate snow poles and signs; said routes being limited to the unplowed roadways. The criteria for determining specific routes in these areas are the most direct access, weather and snow conditions, and the elimination of congestion and improvement of circulation in the interest of public safety.
- *(I)(3) What is a winter use season?* A winter use season is that portion of the winter months that begins each year in approximately late November through the following year ending in approximately the middle of March. Specific dates depend on weather conditions and the availability of NPS facilities and resources and may be adjusted at the discretion of the Superintendent. Appropriate notice will be given to the public of determined start and end dates each season.
- *(I)(4) When snowmobile use is authorized, where may I operate my snowmobile?* You may operate your snowmobile on designated routes established within the park. On designated routes, snowmobile use is limited to the unplowed roadway, which is distinguished as that portion of the roadway located between the road shoulders and is designated by snow poles or other poles, ropes, fencing, or signs erected to regulate snowmobile activity. The unplowed roadway may also be distinguished by the interior boundaries of the berm created by the packing and grooming of the unplowed roadway. Snowmobiles may also be operated in pullouts or parking areas that are groomed or marked similarly to roadways.
- *(I)(5) What routes are designated for snowmobile use in the park during the winter season of 2002–2003?* During the winter use season of 2002–2003, the following routes are designated for snowmobile use:

- (i) The Grand Loop Road from its junction with Terrace Springs Drive to Norris Junction.
  - (ii) Norris Junction to Canyon Junction.
  - (iii) The Grand Loop Road from Norris Junction to Madison Junction.
  - (iv) The West Entrance Road from the park boundary at West Yellowstone to Madison Junction.
  - (v) The Grand Loop Road from Madison Junction to West Thumb.
  - (vi) The South Entrance Road from the south entrance to West Thumb.
  - (vii) The Grand Loop Road from West Thumb to its junction with the East Entrance Road.
  - (viii) The East Entrance Road from the east entrance to its junction with the Grand Loop Road.
  - (ix) The Grand Loop Road from its junction with the East Entrance Road to Canyon Junction.
  - (x) The South Canyon Rim Drive.
  - (xi) Any groomed or marked pullouts or parking areas along each of these routes.
  - (xii) In the developed areas of Madison Junction, Old Faithful, Grant Village, Lake Village, Fishing Bridge, Canyon, Indian Creek, and Norris, snowmobile routes to scenic points of interest, lodging, and other facilities will be designated by appropriate snow poles and signs and will be limited to the unplowed roadways in those areas.
  - (xiii) The Superintendent may open or close these routes after taking into consideration the location of wintering wildlife, appropriate snow cover, and other factors that may relate to public safety.
  - (xiv) Maps detailing the designated routes will be available from Park Headquarters.
- *(l)(6) What criteria may the Superintendent use to determine the routes within the developed areas mentioned in paragraph (l)(5)(xii) of this section?* The Superintendent will use the criteria in Executive Order 11644 (3 CFR, 1971–1975 Comp. p. 666) and may use other criteria to determine use routes within the developed areas of Madison Junction, Old Faithful, Grant Village, Lake, Fishing Bridge, Canyon, Indian Creek, and Norris, including the most direct route of access, weather and snow conditions, and those routes necessary to eliminate congestion and improve the circulation of the visitor use patterns in the interest of public safety.

- (l)(7) *What limits are established for the numbers of snowmobiles permitted to use the park each day?* For the winter use season 2002–2003, the numbers of snowmobiles allowed to use the park each day are listed in Table 1-1.

**Table 1-1. Snowmobile Use in YNP in 2002–2003**

Park Entrance Gate or Area	Maximum Daily Number of Snowmobiles Allowed Per Gate
North Entrance	60
West Entrance	278
East Entrance	65
South Entrance	90

- (l)(8) *May I operate a snowcoach in YNP?* Snowcoaches may be operated in YNP under a concessions contract or permit authorized by the Superintendent. Snowcoach operation is subject to the conditions of the permit and all other conditions identified in this regulation.
- (l)(9) *What is a snowcoach?* A snowcoach is a self-propelled mass transit vehicle intended for travel on snow, having a curb weight of over 1,000 pounds (450 kilograms), driven by a track or tracks and steered by skis or tracks, having a capacity of at least eight passengers.
- (l)(10) *What routes are designated for snowcoach use?* Snowcoaches may operate on the same routes designated for snowmobile use in paragraph (l)(5) of this section and the following designated routes:
  - (i) Firehole Canyon Drive.
  - (ii) Fountain Flat Road.
  - (iii) Virginia Cascades Drive.
  - (iv) North Canyon Rim Drive.
  - (v) Riverside Drive.
  - (vi) Lake Butte Overlook Drive.
  - (vii) The portion of the Grand Loop Road from Canyon Junction to Washburn Hot Springs Overlook.
- (l)(11) *What other conditions are placed on snowmobile and snowcoach operations?* Snowmobiles and snowcoaches may be operated in the park under the following conditions:
  - (i) Snowcoaches, and during the winter use season of 2002–2003 snowmobiles, may not be operated in the park between the hours of 9:00 p.m. and 8:00 a.m. except by authorization.



- (ii) Idling a snowmobile or snowcoach is limited to 10 minutes at any one time.
  - (iii) Snowmobiles or snowcoaches that stop on designated routes must pull over to the far right next to the snow berm. Stopping the vehicle in a hazardous location, or where the view of the vehicle might be obscured, such as on a curve, is prohibited. Pullouts must be used when available and accessible.
  - (iv) Snowmobiles and snowcoaches must be properly registered and display a valid state registration sticker.
  - (v) Snowmobile operators must possess a valid state motor vehicle operator's license or learner's permit. The license or permit must be carried on the operator's person at all times.
  - (vi) Persons operating a snowmobile while possessing a learner's permit must be accompanied and supervised within line of sight, but no further than 100 yards, by a responsible person 21 years of age or older possessing a valid state motor vehicle operator's license.
  - (vii) Allowing or permitting an unlicensed driver to operate a snowmobile is prohibited.
  - (viii) During the winter use season of 2002–2003, snowmobiles must be accompanied by an NPS permitted guide and may not travel in groups of more than 11 snowmobiles.
- *(l)(12) May I operate a snowplane in the park?* The operation of snowplanes in YNP is prohibited.
  - *(l)(13) What is a snowplane?* A snowplane is a self-propelled vehicle intended for over-the-snow travel and driven by a pusher-propeller.
  - *(l)(14) Are there any other forms of oversnow transportation allowed in the park?* No other forms of motorized oversnow transportation are permitted for use in the park unless specifically approved by the Superintendent and are consistent with the requirements of the applicable Executive Orders and the park's management plans.

### 1.3.2 John D. Rockefeller, Jr., Memorial Parkway

The current snowmobile regulations for the Parkway are as follows:

#### §7.21 John D. Rockefeller, Jr., Memorial Parkway

- *(a)(1) May I operate a snowmobile in the Parkway?* You may operate a snowmobile in the Parkway in compliance within the public use limits and operating conditions established in this section until the end of the winter use season of 2002–

2003 at which time snowmobile use in the Parkway is prohibited except for essential administrative use and in emergency situations as determined by the Superintendent.

- (a)(2) *What routes are designated for snowmobile use in the Parkway prior to the winter use season of 2002–2003?* Effective until the end of the winter use season of 2001–2002, the following are the designated routes to be open to snowmobile use:
  - (i) The Ashton-Flagg Ranch Road between the western boundary of the Parkway and its junction with U.S. Highway 89-287.
  - (ii) The unplowed portion of U.S. Highway 89-287 between Flagg Ranch and the south boundary of YNP.
- (a)(3) *What is a winter use season?* A winter use season is that portion of the winter months that begins each year in approximately late November through the following year ending in approximately the middle of March. Dates depend on weather conditions and the availability of NPS facilities and resources and may be adjusted at the discretion of the Superintendent. Appropriate notice will be given to the public of determined start and ending dates each season.
- (a)(4) *What routes are designated for snowmobile use in the Parkway in the winter season of 2002–2003?* During the winter use season of 2002–2003, the following routes may be designated for snowmobile use:
  - (i) The Continental Divide Snowmobile Trail (CDST) along U.S. Highway 89/287 from the southern boundary of the Parkway to Flagg Ranch.
  - (ii) Along U.S. Highway 89/287 from Flagg Ranch to the northern boundary of the Parkway.
  - (iii) Grassy Lake Road from Flagg Ranch to the western boundary of the Parkway.
  - (iv) The Superintendent may open or close these routes after considering the location of wintering wildlife, appropriate snow cover, and other factors that may relate to public safety.
  - (v) Maps detailing the designated routes will be available from Park Headquarters.
- (a)(5) *What limits are established for the numbers of snowmobiles permitted to use the Parkway each day?* For the winter use season 2002–2003, the numbers of snowmobiles allowed to use the Parkway each day are listed in Table 1-2.

**Table 1-2. Snowmobile Use in the Parkway in 2002–2003**

Park Entrance Gate or Area	Maximum Daily Number of Snowmobiles Allowed Per Gate
Continental Divide Snowmobile Trail (along U.S. 89/287) from the southern boundary of the JDR Parkway to Flagg Ranch	25
(Along U.S. 89/287) Flagg Ranch to northern boundary of Parkway	90
Grassy Lake Road	25

- *(a)(6) May I operate a snowcoach in the Parkway?* Snowcoaches may be operated in the Parkway under a concessions contract or permit authorized by the Superintendent. Snowcoach operation is subject to the conditions of the permit and all other conditions identified in this regulation.
- *(a)(7) What is a snowcoach?* A snowcoach is a self-propelled mass transit vehicle intended for travel on snow, having a curb weight of over 1,000 pounds (450 kilograms), driven by a track or tracks and steered by skis or tracks, having a capacity of at least eight passengers.
- *(a)(8) What routes are designated for snowcoach use?* Snowcoaches may operate on the routes designated for snowmobile use in paragraphs (a)(4)(i) through (iii) of this section.
- *(a)(9) What other conditions are placed on snowmobile and snowcoach operations?* Snowmobiles and snowcoaches may be operated under the following conditions:
  - (i) Snowmobiles or snowcoaches that stop on designated routes must pull over to the far right next to the snow berm. Stopping the vehicle in a hazardous location, or where the view of the vehicle might be obscured, such as on a curve, is prohibited. Pullouts must be used when available and accessible.
  - (ii) Snowmobiles and snowcoaches must be properly registered and display a valid state registration sticker.
  - (iii) Snowmobile operators must possess a valid state motor vehicle operator's license or learner's permit. The license or permit must be carried on the operator's person at all times.
  - (iv) Persons operating a snowmobile while possessing a learner's permit must be accompanied and supervised within line of sight, but no further than 100 yards, by a responsible person 21 years of age or older possessing a valid state motor vehicle operator's license.

- (v) Allowing or permitting an unlicensed driver to operate a snowmobile is prohibited.
- (vi) Snowcoaches, and during the winter use season of 2002–2003 snowmobiles, may not be operated in the Parkway between the hours of 9:00 p.m. and 8:00 a.m. except by authorization.
- (a)(10) *May I operate a snowplane in the Parkway?* The operation of snowplanes in the Parkway is prohibited.
- (a)(11) *What is a snowplane?* A snowplane is a self-propelled vehicle intended for over-the-snow travel and driven by a pusher-propeller.
- (a)(12) *Are there any other forms of oversnow transportation allowed in the Parkway?* No other forms of motorized oversnow transportation are permitted for use in the Parkway unless specifically approved by the Superintendent and are consistent with the requirements of the applicable Executive Orders and the park's management plans.

### **1.3.3 Grand Teton National Park**

The current snowmobile regulations for GTNP are as follows:

#### **§7.22 Grand Teton National Park**

- (g)(1) *May I operate a snowmobile in GTNP?* Until the end of the winter use season of 2001–2002, you may operate a snowmobile on the routes and areas designated in paragraphs (g)(2) through (g)(4) of this section in compliance with operating standards established by the Superintendent. During the winter use season of 2002–2003, you may operate a snowmobile on the route designated in paragraph (g)(6) of this section in compliance with the public use limits and operating standards established by the Superintendent. Effective the winter use season of 2003–2004, snowmobile use will be restricted to the routes and purposes in paragraphs (g)(10), (11), (12), and (13) of this section. All other snowmobile use is prohibited, except for essential administrative use and in emergency situations as determined by the Superintendent.
- (g)(2) Effective until the end of the winter use season 2001–2002, the following are the designated routes to be open to snowmobile use: the Spread Creek Road; the unplowed portion of the Pacific Creek Road; the unplowed portion of the Ditch Creek Road; the Lost Creek Ranch Road, those portions of the unplowed roads connecting with the Shadow (Antelope) Mountain Forest Service Road at Cunningham Cabin, Lost Creek Road and Antelope Flats Road; the unplowed portions of the Moose-Wilson Road; and the unplowed portion of the Teton Park Road north of Cottonwood Creek to a line of markers south of Timbered Island, around the east side of Timbered Island north to the

line of markers at South Jenny Lake Junction, and then north to Signal Mountain Lodge, except during the period previous to opening of Potholes-Baseline Flats areas when the Teton Park Road will be open through to Signal Mountain, the Jenny Lake Loop Road, the Spalding Bay Road, the String Lake Picnic Area Road, the Signal Mountain Summit Road, the Signal Mountain Launch Ramp Road, and the Lizard Creek Campground Road.

- (g)(3) Effective until the end of the winter use season 2001–2002, the following are the designated areas open to snowmobile use: the Potholes-Baseline Flats area east of the Teton Park Road north of the Cottonwood Creek, north of the Bar BC access road, east of Timbered Island, west of the River Road or as marked at the top of the Snake River Bench, northwest of Timbered Island as marked to the Teton Park Road and bounded on the north by the RKO Road.
- (g)(4) Effective until the end of the winter use season 2001–2002, the following water surface is designated for snowmobile and snowplane use: the frozen surface of Jackson Lake.
- (g)(5) *What is a winter use season?* A winter use season is that portion of the winter months that begins each year in approximately late November, through the following year ending in approximately the middle of March. Specific dates depend on weather conditions and the availability of park facilities and resources and may be adjusted at the discretion of the Superintendent. Appropriate notice will be given to the public of determined start and end dates each season.
- (g)(6) *What routes are designated for snowmobile use in the park during the winter use season of 2002–2003?* For the winter use season of 2002–2003, the Continental Divide Snowmobile Trail along U.S. 26/287 from Moran to the eastern park boundary and along U.S. 89/287 from Moran to the north park boundary is designated for snowmobile use. The Superintendent may open or close this route after taking into consideration the location of wintering wildlife, appropriate snow cover, and other factors that may relate to public safety. A maximum of 25 snowmobiles is allowed to use this route each day (see Table 1-3).

**Table 1-3. Snowmobile Use in GTNP in 2002–2003**

Park Entrance Gate or Area	Maximum Daily Number of Snowmobiles Allowed Per Gate
Continental Divide Snowmobile Trail from east park boundary (along U.S. 26/287) to northern park boundary (along U.S. 89/287)	25

- *(g)(7) What other conditions are placed on snowmobile operations?* Snowmobiles may be operated in the park under the following conditions:
  - (i) Snowmobiles that stop on designated routes must pull over to the far right next to the snow berm. Stopping the vehicle in a hazardous location, or where the view of the vehicle might be obscured, such as on a curve, is prohibited. Pullouts must be used when available and accessible.
  - (ii) Snowmobiles must be properly registered and display a valid state registration sticker.
  - (iii) Snowmobile operators must possess a valid state motor vehicle operator's license or learner's permit. The license or permit must be carried on the operator's person at all times. Snowmobile operators are not required to possess a valid driver's license while operating on the public access routes designated in paragraph (g)(10) and the private property access routes designated in paragraph (g)(12).
  - (iv) Persons operating a snowmobile while possessing a learner's permit must be accompanied and supervised within line of sight, but no farther than 100 yards, by a responsible person 21 years of age or older possessing a valid state motor vehicles operator's license.
  - (v) Allowing or permitting an unlicensed driver to operate a snowmobile is prohibited.
  - (vi) Snowcoaches, and during the winter use season of 2002–2003 snowmobiles, may not be operated in the park between the hours of 9:00 p.m. and 8:00 a.m.
- *(g)(8) May I operate a snowplane in the park?* If you had a permit to operate a snowplane on Jackson Lake during the winter use season 2000–2001, you may obtain a permit to operate a snowplane on Jackson Lake during the winter use season of 2001–2002. Effective at the end of the winter use season of 2001–2002, snowplane use in GTNP is prohibited.
- *(g)(9) What is a snowplane?* A snowplane is a self-propelled vehicle intended for over-the-snow travel and driven by a pusher-propeller.
- *(g)(10) May I continue to access public lands via snowmobile through the park?* Reasonable and direct access via snowmobile to adjacent public lands will continue to be permitted on designated routes through GTNP. The following routes are designated for access via snowmobile to public lands:
  - (i) From the parking area at Shadow Mountain directly along the unplowed portion of the road to the east park boundary.

- (ii) Along the unplowed portion of the Ditch Creek Road directly to the east park boundary.
- (iii) From the Cunningham Cabin pullout on U.S. 26/89 near Triangle X to the east park boundary.
- (g)(11) *For what purpose may I use the routes designated in paragraph (g)(10) of this section?* You may use those routes designated in paragraph (g)(10) of this section to gain direct access to public lands adjacent to the park boundary.
- (g)(12) *May I continue to access private property within or adjacent to the park via snowmobile?* Reasonable and direct access via snowmobile to private property will continue to be permitted via designated routes in the park. The following routes are designated for access to private property within or adjacent to the park:
  - (i) The unplowed portion of Antelope Flats Road off U.S. 26/89 to private lands in the Craighead Subdivision.
  - (ii) The unplowed portion of the Teton Park Road to that piece of land commonly referred to as the “Clark Property.”
  - (iii) From the Moose-Wilson Road to the land commonly referred to as the “Barker Property” until the Department of the Interior takes full possession of that land.
  - (iv) From the Moose-Wilson Road to the land commonly referred to as the “Wittimer Property” until the Department of the Interior takes full possession of that land.
  - (v) From the Moose-Wilson Road to those two pieces of land commonly referred to as the “Halpin Properties.”
  - (vi) From either end of the plowed sections of the Moose-Wilson Road to that piece of land commonly referred to as the “JY Ranch.”
  - (vii) From Highway 26/89/187 to those lands commonly referred to as the “Meadows,” the “Circle EW Ranch,” the “Moulton Property,” the “Levinson Property,” and the “West Property.”
  - (viii) From Cunningham Cabin pullout on U.S. 26/89 near Triangle X to the piece of land commonly referred to as the “Lost Creek Ranch.”
  - (ix) Maps detailing designated routes will be available from Park Headquarters.
- (g)(13) *For what purpose may I use the routes designated in paragraph (g)(12) of this section?* Those routes designated in paragraph (g)(12) of this section are to access private property within or directly adjacent to the park boundary. Use of these roads via snowmobile is authorized only for the

landowner or their representatives or guests. Recreational use of these roads by anyone is prohibited.

- *(g)(14) Are there any forms of oversnow transportation allowed in the park?* No other forms of motorized oversnow transportation are permitted for use in the park unless specifically approved by the Superintendent and are consistent with the requirements of the applicable Executive Orders and the park's management plans.

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## 1.4 DELAY RULE REGULATIONS

As described above, NPS is proposing to postpone the implementation of the existing snowmobile regulation in YNP, the Parkway, and GTNP for one year to provide additional time necessary to complete the SEIS. To this end, NPS has proposed the following amendments to 36 CFR Part 7:<sup>4</sup>

### 1.4.1 Yellowstone National Park

In §7.13, remove and reserve (1)(2), revise the introductory text of paragraph (1)(5), revise the introductory text of paragraph (1)(7), revise paragraph (1)(11)(i), and revise the dates in the first sentence of (1)(11)(viii) to read as follows:

#### §7.13 Yellowstone National Park

\* \* \* \* \*

- (l)(2) [Removed and Reserved]

\* \* \* \* \*

- *(l)(5) What routes are designated for snowmobile use in the park during the winter seasons of 2002–2003 and 2003–2004?* During the winter use seasons of 2002–2003 and 2003–2004, the following routes are designated for snowmobile use:

\* \* \* \* \*

- *(l)(7) What limits are established for the number of snowmobiles permitted to use the park each day?* For the winter use season 2003–2004, the numbers of snowmobiles allowed to use the park each day are listed in the following table:

\* \* \* \* \*

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<sup>4</sup>Only text that changes based on the proposed amendments has been included here; asterisks indicate intervening text that remains unchanged (see Section 1.1).



- (l)(11)(i) Snowcoaches, and during the winter use seasons of 2002–2003 and 2003–2004 snowmobiles, may not be operated in the park between the hours of 9:00 p.m. and 7:00 a.m. except by authorization.

\* \* \* \* \*

- (l)(11)(viii) During the winter season of 2003–2004, snowmobiles must be accompanied by an NPS permitted guide and may not travel in groups of more than 11 snowmobiles.

\* \* \* \* \*

#### **1.4.2 John D. Rockefeller, Jr., Memorial Parkway**

In §7.21, revise paragraph (a)(1), remove and reserve paragraph (a)(2), revise paragraph (a)(4) introductory text, revise paragraph (a)(5) introductory text, and revise paragraph (a)(9)(vi) to read as follows:

##### **§7.21 John D. Rockefeller, Jr., Memorial Parkway**

\* \* \* \* \*

- *(a)(1) May I operate a snowmobile in the Parkway? You may operate a snowmobile in the Parkway in compliance within the public use limits and operating conditions established in this section until the end of the winter use season of 2003–2004 at which time snowmobile use in the Parkway is prohibited except for essential administrative use and in emergency situations as determined by the Superintendent.*
- (a)(2) [Removed and Reserved]

\* \* \* \* \*

- *(a)(4) What routes are designated for snowmobile use in the Parkway in the winter use seasons of 2002–2003 and 2003–2004? During the winter use seasons of 2002–2003 and 2003–2004, the following routes are designated for snowmobile use:*

\* \* \* \* \*

- *(a)(5) What limits are established for the number of snowmobiles permitted to use the Parkway each day? For the winter use season 2003–2004, the numbers of snowmobiles allowed to use the Parkway each day are listed in the following table:*

\* \* \* \* \*

- (a)(9)(vi) Snowcoaches, and during the winter use seasons of 2002–2003 and 2003–2004 snowmobiles, may not be operated in the park between the hours of 9:00 p.m. and 8:00 a.m. except by authorization.

\* \* \* \* \*

### **1.4.3 Grand Teton National Park**

In §7.22, revise paragraph (g)(1), remove and reserve paragraphs (g)(2) and (g)(3), revise paragraph (g)(4), revise paragraph (g)(6), and revise paragraph (g)(7)(vi) to read as follows:

#### **§7.22 Grand Teton National Park**

\* \* \* \* \*

- *(g)(1) May I operate a snowmobile in Grand Teton National Park?* During the winter use seasons of 2002–2003 and 2003–2004, you may operate a snowmobile on the routes designated in paragraphs (g)(4) and (g)(6) of this section in compliance with public use limits and operating standards established by the Superintendent. Effective the winter use season of 2004–2005, snowmobile use will be restricted to the routes and purposes in paragraphs (g)(10), (11), (12), and (13) of this section. All other snowmobile use is prohibited, except for essential administrative use and in emergency situations as determined by the Superintendent.
- (g)(2) [Removed and Reserved]
- (g)(3) [Removed and Reserved]
- (g)(4) Effective until the end of the winter use season 2002–2003, the following surface is designated for snowmobile use: The frozen surface of Jackson Lake.

\* \* \* \* \*

- *(g)(6) What routes and limits are designated for snowmobile use in the park during the winter use seasons of 2002–2003 and 2003–2004?* For the winter use seasons of 2002–2003 and 2003–2004, the Continental Divide Snowmobile Trail along U.S. 26/287 from Moran to the eastern park boundary and along U.S. 89/287 from Moran to the north park boundary is designated for snowmobile use. The Superintendent may open or close this route after taking into consideration the location of wintering wildlife, appropriate snow cover, and other factors that may relate to public safety. During the winter use season of 2003–2004 a maximum of 25 snowmobiles are allowed to use this route each day.

\* \* \* \* \*

- (g)(7)(vi) Snowcoaches, and during the winter use seasons of 2002–2003 and 2003–2004 snowmobiles, may not be

operated in the park between the hours of 9:00 p.m. and 8:00 a.m.

\* \* \* \* \*

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## **1.5 DESCRIPTION OF IMPACTS ANALYZED**

Delaying implementation of the existing snowmobile regulations for YNP, GTNP, and the Parkway potentially could result in different economic and environmental consequences in the winter use seasons of 2002–2003 and 2003–2004 than if the current rule remained in effect for those years. Therefore, evaluating and incorporating these impacts into the benefit-cost and small business analyses is necessary. For the purpose of assessing economic and environmental impacts, the following sections define the “baseline” and the “delay rule” conditions for each of the potentially affected years. By the winter use season of 2004–2005, snowmobiles would not be permitted in the parks under either the current or the proposed regulations. A summary of the number of snowmobiles to be allowed in the parks each year under the baseline and delay rule is provided in Table 1-4.

### **1.5.1 Winter Use Season 2002–2003**

*Baseline:* The current rule would have resulted in caps on numbers at the various park entrances and implemented the requirement that snowmobiles in YNP be accompanied by an NPS-permitted guide.

*Delay Rule:* Under the proposed rule, there would be no limits on the numbers of snowmobiles allowed access into all three parks and no requirement that snowmobiles in YNP be accompanied by an NPS-permitted guide.

**Table 1-4. Summary of the Number of Snowmobiles to be Allowed in the Parks Each Year Under the Baseline and Delay Rule**

Park Entrance Gate or Area	Maximum Daily Number of Snowmobiles Allowed Per Gate					
	Baseline Regulations			Delay Rule		
	2002– 2003 <sup>a</sup>	2003– 2004	2004– 2005	2002– 2003	2003– 2004 <sup>a</sup>	2004– 2005
<b>YNP</b>						
North Entrance	60	Ban	Ban	Unrestricted	60	Ban
West Entrance	278	Ban	Ban	Unrestricted	278	Ban
East Entrance	65	Ban	Ban	Unrestricted	65	Ban
South Entrance	90	Ban	Ban		90	Ban
<b>GTNP</b>						
Continental Divide Snowmobile Trail (along U.S. 89/287) from the southern boundary of the JDR Parkway to Flagg Ranch	25	Ban	Ban	Unrestricted	25	Ban
(Along U.S. 89/287) Flagg Ranch to northern boundary of Parkway	90	Ban	Ban	Unrestricted	90	Ban
Grassy Lake Road	25	Ban	Ban	Unrestricted	25	Ban
<b>The Parkway</b>						
Continental Divide Snowmobile Trail from east park boundary (along U.S. 26/287) to northern park boundary (along U.S. 89/287)	25	Ban	Ban	Unrestricted	25	Ban

<sup>a</sup>Guided tours only in YNP.

### 1.5.2 Winter Use Season 2003–2004

*Baseline:* The current rule would have prohibited recreational snowmobile use in all the parks and allowed motorized oversnow access to the parks via snowcoach.<sup>5</sup>

<sup>5</sup>Although the January 22, 2001, amendments to 36 CFR Part 7 do not identify specific regulations governing snowmobile use in YNP during the 2003–2004 winter use season, for the purposes of the analyses in this report it is assumed that all oversnow motorized visitor travel in YNP will be by snowcoach (as stated in the November 22, 2000, ROD); therefore, snowmobiles will be banned from the YNP.

*Delay Rule:* Under the proposed rule, caps on numbers at the various park entrances and the requirement that snowmobiles in YNP be accompanied by an NPS-permitted guide would become effective.

# 2

## Baseline Description of Snowmobile Riding in the Greater Yellowstone Area

Section 2 describes the baseline conditions against which changes brought about by the delay rule will be measured.

### 2.1 THE GREATER YELLOWSTONE AREA

The GYA encompasses over 11 million acres and is considered one of the few remaining intact temperate ecosystems on earth. Within the area, YNP comprises 2.22 million acres, primarily in northwestern Wyoming and extending into south-central Montana and eastern Idaho. GTNP encompasses an additional 310,000 acres, the Parkway includes 24,000 acres, and both are located in Wyoming. YNP and GTNP comprise the strategic core of an upland plateau called the GYA. Portions of six national forests—Gallatin, Custer, Shoshone, Bridger-Teton, Caribou-Targhee, and the Beaverhead-Deerlodge—border the parks and are within the GYA, as are the National Elk Refuge and Red Rocks National Wildlife Refuge. Public lands make up most of the area (69 percent). Private lands comprise 24 percent of the GYA, Indian reservations comprise 4 percent, and 3 percent of the lands in the GYA are state lands. The GYA extends across 17 counties in three states. Cooperative agreements and interagency planning and coordination aid in managing the entire area as an ecological unit, while at the same time recognizing the different mandates of the land management agencies.

#### 2.1.1 Yellowstone National Park

YNP was “dedicated and set apart as a public park or pleasuring ground for the benefit and enjoyment of the people” and “for the

preservation, from injury or spoilation, of all timber, mineral deposits, natural curiosities, or wonders ... and their retention in their natural condition” by an Act of Congress on March 1, 1872 (see Figure 2-1). Yellowstone is the first and oldest national park in the world.

The commanding features that initially attracted interest and led to the preservation of Yellowstone as a national park were geological: the geothermal phenomena (there are more geysers and hot springs here than in the rest of the world combined), the colorful Grand Canyon of the Yellowstone River, fossil forests, and the size and elevation of Yellowstone Lake.

Four gateway communities and park entrances serve as local access to the park in the winter:

- The north entrance of the park provides direct access from Gardiner, Montana, via U.S. Highway 89, and is located 54 miles south of Livingston, Montana.
- The east entrance connects the park with Cody, Wyoming, 53 miles to the east via U.S. Highway 16.
- The John D. Rockefeller, Jr., Memorial Parkway (U.S. Highway 89/287) provides access to the park from the south and connects the park to Jackson, Wyoming, 64 miles from the south entrance.
- U.S. Highways 20 and 287 serve access to the west entrance through West Yellowstone, Montana.

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*Only the roads connecting the north and northeast entrances are plowed for passenger wheeled-vehicular traffic during the winter. The remaining entrance roads are among those groomed for oversnow travel.*

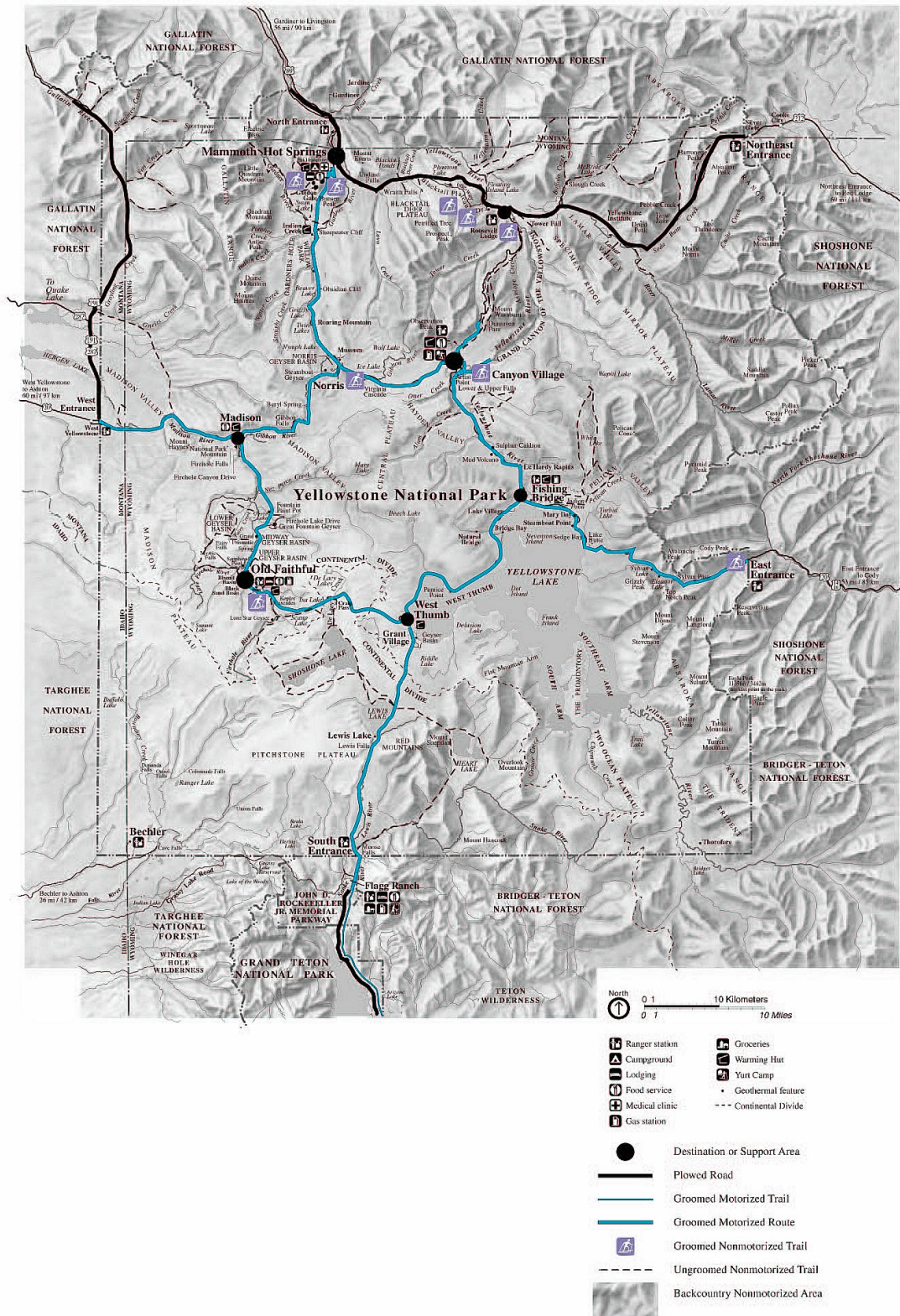
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Only the roads connecting the north and northeast entrances are plowed for passenger wheeled-vehicular traffic during the winter. The remaining entrance roads are among those groomed for oversnow travel.

### **2.1.2 Grand Teton National Park**

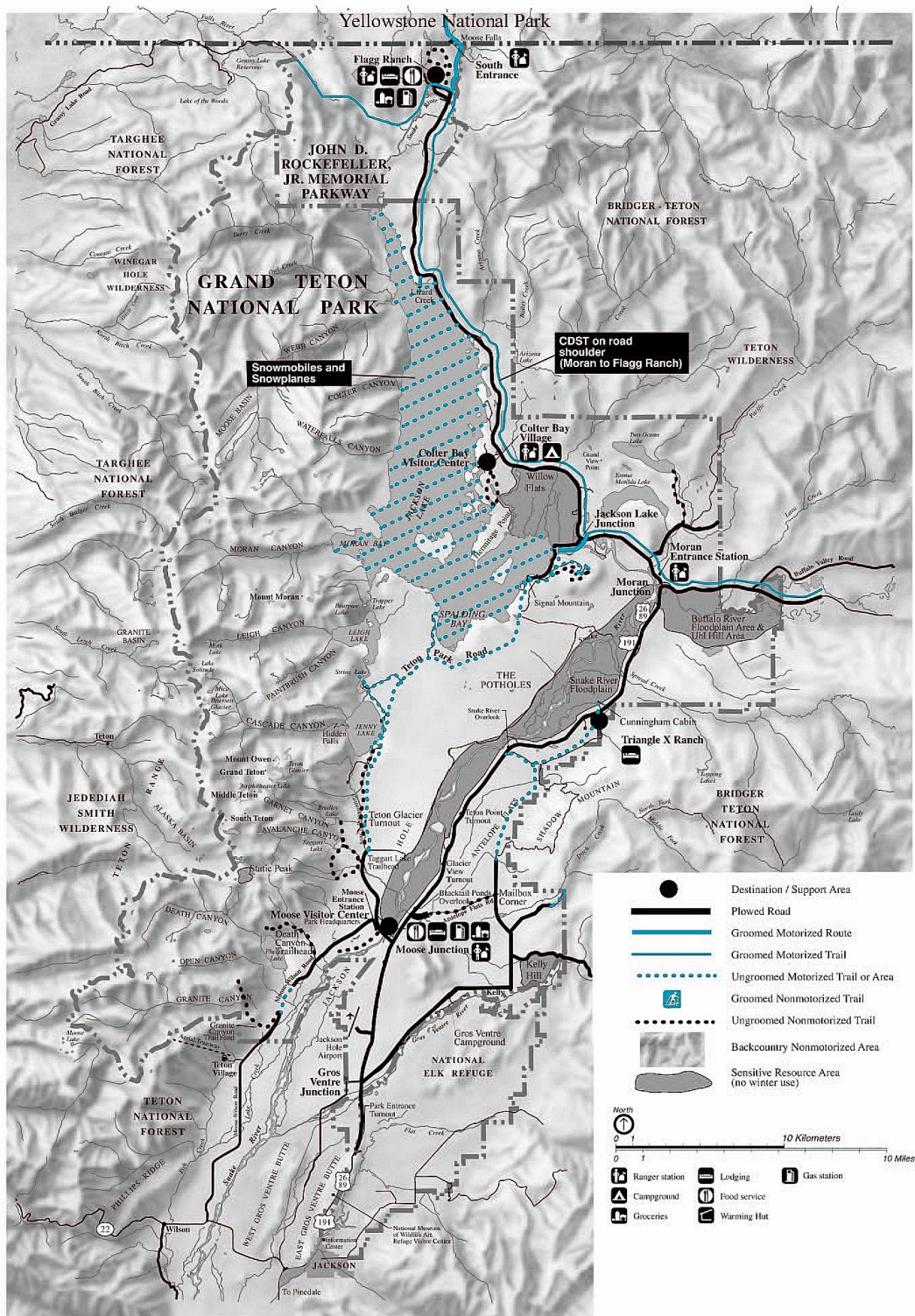
Towering more than a mile above the valley known as Jackson Hole, the Grand Teton rises to 13,770 feet above sea level. Twelve Teton peaks reach above 12,000 feet elevation, high enough to support a dozen mountain glaciers. In contrast to the abrupt eastern face, the west side of the range slopes gently, showing the angle of tilt of the earth’s crust. Youngest of the mountains in the Rocky Mountain system, the Teton Range displays some of North America’s oldest rocks. The region was first designated a national park in 1929 (see Figure 2-2).

**Figure 2-1. Map of Yellowstone National Park**





**Figure 2-2. Map of Grand Teton National Park and the Parkway**



GTNP is located immediately south of the Parkway and is bounded on the south by the National Elk Refuge. The primary gateway community for GTNP—Jackson, Wyoming—is located about 3 miles south of the park boundary and is connected to the park via the Parkway (U.S. Highway 26/89 and 191). Additional regional access to GTNP is provided at the east entrance, near Moran, Wyoming, which connects the area with Wyoming cities to the east, including Dubois, 50 miles from the park via U.S. Highway 26/287. This route also connects regions east of GTNP to YNP, via the Parkway (U.S. Highway 89 and 191/287) from Moran, through the Parkway boundary to the south entrance of YNP. The entire Parkway within GTNP, as well as U.S. Highway 26/287 from the eastern park border to Moran Junction, is maintained for wheeled-vehicle use throughout the year.

### **2.1.3 John D. Rockefeller, Jr., Memorial Parkway**

The Parkway encompasses 24,000 acres directly between YNP and GTNP and is also a roadway through GTNP (see Figure 2-2). The Parkway was established in 1972 and is administered by GTNP. Within the Parkway boundary, the roadway itself traverses 7.5 miles between the northern boundary of GTNP and the south entrance of YNP. The Parkway in its entirety is an 82-mile scenic corridor linking the West Thumb in YNP with the south entrance of GTNP. The Parkway is open year round between the northern border of GTNP and Flagg Ranch but closed in winter to wheeled vehicles from Flagg Ranch to the West Thumb in YNP. Flagg Ranch is the major visitor destination within the Parkway boundary, and it serves as a principal winter staging area for oversnow access to YNP.

## 2.2 SNOWMOBILE TRAILS

### 2.2.1 Yellowstone National Park

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*Typical snowmobile staging areas for trips into YNP are near Mammoth Hot Springs in the north, in West Yellowstone near the west entrance, at a parking area at Flagg Ranch in the Parkway near the south entrance, and at Pahaska Teepee in the Shoshone National Forest near the east entrance.*

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Snowmobiling within YNP can be described as both recreational and destination-oriented in nature. Many of the routes described below lead to particular geothermal or other natural features and scenic vistas and/or provide opportunities for wildlife viewing. Some of the routes also provide access to winter lodging facilities within the park boundary. The following 12 paved road segments, totaling 184.6 miles, are closed to passenger vehicles during the winter and are groomed by the Park Service for oversnow motorized vehicle use, including snowmobiles, between mid-December and mid-March (see Figure 2-1). The 12 segments together provide snowmobilers with the opportunity to travel the entire Grand Loop Road from each of the four entrances to YNP. Typical snowmobile staging areas for trips into YNP are near Mammoth Hot Springs in the north, in West Yellowstone near the west entrance, at a parking area at Flagg Ranch in the Parkway near the south entrance, and at Pahaska Teepee in the Shoshone National Forest near the east entrance. A brief description of the trails is provided below.

- Grand Loop Road from Mammoth Hot Springs (5 miles south of the north entrance) south to Norris Junction (22.6 miles): Mammoth Hot Springs is the site of YNP headquarters and offers a full range of visitor services and access to geothermal features. From Mammoth Hot Springs this route follows the Gardiner and Obsidian Creek drainage basins through a number of significant natural and cultural features, including the Norris Geyser Basin, the largest and thermally hottest basin in the park. This route also provides numerous opportunities for wildlife viewing, particularly elk and bison in the Norris Geyser basin. There is a warming hut at Indian Creek, just south of Mammoth.
- Grand Loop Road from Norris Junction southwest to Madison Junction (13.7 miles): This snowmobile route follows the Gibbon River through Gibbon Canyon en route to its confluence with the Madison River at Madison Junction. The route passes through scenic mountain meadows, follows the rim of the Yellowstone Caldera, and includes scenic destinations such as the cliff formations at Gibbon Falls and Gibbon Geyser Basin. Thermal areas provide opportunities for wildlife viewing.
- West Entrance Road from Madison Junction to the park boundary at the west entrance (13.7 miles): The first half of this route traverses Madison Canyon and is flanked by the

National Park Mountains and Mounts Haynes and Jackson. The second half of the route provides access to the Madison River via numerous informal pullouts and drives. The thermal areas along this route provide numerous opportunities for wildlife viewing.

- Grand Loop Road from Madison south to Old Faithful (16.6 miles): This route follows the banks of the Firehole River. More than 300 geysers and 10,000 other thermal features are found along or near this route, more than the combined total in all other locations around the world. These thermal areas attract many large mammals, particularly elk and bison near the hot springs areas. A gasoline station and two warming huts operate in the vicinity of Old Faithful.
- Grand Loop Road from Old Faithful west to West Thumb (17.8 miles): This route follows the Firehole River from Old Faithful to the Kepler Cascades. The route crosses the Continental Divide at Craig Pass (at over 8,200 feet) before descending into the West Thumb area. Thermal features in West Thumb provide opportunities for wildlife viewing, and there is a warming hut in this area.
- The South Entrance Road from West Thumb to the south entrance (22 miles): This route begins at the West Thumb Geyser Basin, a thermal area on the shore of Yellowstone Lake. Approximately 10 miles from West Thumb, the route follows the eastern shore of Lewis Lake, passes Lewis Falls, parallels the Lewis River, and traverses the Lewis River canyon. Shortly before the south entrance the route parallels the Snake River drainage. At the southern park boundary, the route continues into the Parkway (described below).
- Grand Loop Road from West Thumb northeast to Fishing Bridge (20 miles): This route follows the western shore of Yellowstone Lake, providing excellent views of the lake, and traversing dense stands of lodgepole pine that include areas providing excellent moose habitat. Other wildlife frequently observed along this route are elk and bison.
- East Entrance Road from Fishing Bridge to the east entrance (25.4 miles): A gas station and warming hut are available in Fishing Bridge. From Fishing Bridge this route crosses the Pelican Valley, follows the northern edge of Yellowstone Lake, crosses Sylvan Pass in the Absaroka Range, and descends along the eastern edge of the Yellowstone Plateau to the eastern park border. The trailhead actually terminates 2 miles east of the park boundary, and the route provides access to Cody, Wyoming, 53 miles to the east.
- Grand Loop Road from Fishing Bridge to Canyon Junction (15.7 miles): This route closely follows the Yellowstone River between Fishing Bridge and Canyon Village. In Fishing Bridge the route provides access to the Lake developed area as well as the East Entrance Road. Features of interest along this route include the Mud Volcano and

Sulfur Cauldron thermal areas, which are particularly active features, and abundant wildlife viewing opportunities. In Canyon Village there is a gasoline station and a warming hut.

- A portion of the Grand Loop Road from Canyon Village Junction to the Washburn Hot Springs Overlook (approximately 4 miles): The portion of the road designated for snowmobiling provides opportunities to observe diverse populations of animals, including moose and deer, and a wide variety of vegetation, including species characteristic of alpine tundra. The remainder of this route from Washburn Overlook to Tower Junction, while designated in the 1982 36 CFR, is closed to snowmobile travel due to avalanche danger.
- In the vicinity of Canyon Village, both the North and South Rim Drives off Grand Loop Road (totaling less than 2.5 miles): North Rim Drive loop provides access to a number of scenic vistas along the north side of the Yellowstone River, including Grand View, which provides spectacular views of the canyon. South Rim Drive leads to Artist Point, providing a view of the canyon and lower falls.
- Grand Loop Road from Canyon Village to Norris Junction (13.1 miles): This route completes the Grand Loop “tour” and terminates at Norris Junction, the location of the largest and thermally hottest basin in the park.

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*Snowmobiles are permitted along routes to scenic points of interest, lodging, and other facilities that are designated by appropriate snow poles and signs. These routes are limited to the unplowed surface of typically paved roads.*

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### **2.2.2 Grand Teton National Park**

In addition, in the developed areas of Madison Junction, Old Faithful, Grant Village, Lake Village, Fishing Bridge, Canyon Village, and Norris Junction, snowmobiles are permitted along routes to scenic points of interest, lodging, and other facilities that are designated by appropriate snow poles and signs. These routes are limited to the unplowed surface of typically paved roads.

Four routes designated in the January 2001 CFR for use in the winter season of 2001–2002 (and not 2002–2003), but that have not been opened for several years because of prior park management decisions, are the Virginia Cascades Drive, Blacktail Plateau Drive, Fountain Flat Drive, and the section of Grand Loop Road from the Washburn Hot Springs Overlook to Tower Junction.

Snowmobiling in GTNP can be characterized as both destination- and scenic route-oriented as well as for access to other areas (see Figure 2-2). Groomed and ungroomed trails currently designated in the January 2001 CFR and opened annually in GTNP total approximately 55 miles and are described in detail below. A

number of these routes are designated for snowmobile use only through the end of the 2001–2002 winter season (see (g)(1) through (g)(4) in Section 1.1.3). However, many of the designated routes provide access to private property within or adjacent to the park. All of these routes traverse the unplowed portions of roads open to wheeled vehicles at other times of the year and are a mix of paved and unpaved roads. These access routes will remain open to snowmobiles, as indicated in Section 1.1.3, paragraphs (g)(10) through (g)(13).

Moose-Wilson Road, in the southern portion of GTNP, extends southwest from the Moose Visitor Center to the park boundary and on to the towns of Teton Village and Wilson. Although each end of the road is plowed, snowmobiles are permitted on an unplowed 2-mile stretch between Granite Canyon Trailhead in the south and the JY Ranch entrance. This road, along both its plowed and unplowed portions, provides access to several private inholdings.

Although sections of Teton Park Road, which traverses the eastern edge of the Teton Range between Moose and Jackson Lake Junctions, are plowed for wheeled-vehicle use in winter, the nearly 15-mile portion between the Taggart Lake Trailhead to Signal Mountain Lodge is unplowed and available for snowmobile travel. The approximately 3-mile long Signal Mountain summit road remains unplowed and open to snowmobiles in winter.

Snowmobiles may travel short spurs to scenic destinations off of Teton Park Road, including the access roads to String and Jenny Lakes, the Jenny Lake Loop (about 5 miles), and a short access route to Spalding Bay at the south end of Jackson Lake. It should be noted that the Continental Divide Snowmobile Trail (CDST), not designated for use in the current CFR until the winter use season of 2002–2003 and described in detail below, connects snowmobilers on Teton Park Road with the Parkway and YNP.

Numerous short routes designated within GTNP provide access between the park and nearby national forest lands. These include the unplowed portion of Ditch Creek Road directly to the east park boundary into the Bridger-Teton National Forest; and the unplowed portions of Shadow Mountain Road from the parking lot east to the park boundary, leading into the Bridger-Teton National Forest, and the Cunningham Cabin pullout on U.S. Highway 26/89 east to the park boundary, which permits access into the Bridger-Teton



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*Snowmobile use in the Jackson Lake area is a mix of recreational use, access to fishing, and access to other winter activities, such as backcountry skiing, from the west side of the lake.*

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National Forest. Specific routes designating access to private lands within or outside the park when the roads are unplowed are described in Section 1.1.3 of the current CFR.

Snowmobiling is currently permitted on the frozen surface of Jackson Lake, but only through the end of the winter use season 2001–2002. Snowmobiles are permitted to access the lake on the Signal Mountain Launch Ramp Road, as well as at Spalding Bay, as indicated above. Snowmobile use in the Jackson Lake area is a mix of recreational use, access to fishing, and access to other winter activities, such as backcountry skiing, from the west side of the lake.

The CDST, designated for snowmobile use in the CFR during the 2002–2003 winter season, is a groomed snowmobile trail constructed in GTNP and the Parkway during the winter. It provides access to NPS lands from trail systems on the adjacent Shoshone and Bridger-Teton National Forests out of Jackson and Dubois. The CDST is located immediately adjacent to the plowed road, following U.S. Highway 26/287 from the east park boundary to Moran Junction, and then following the Parkway road north through the Parkway to Flagg Ranch. In many areas the CDST occupies the roadway right-of-way and constricts wheeled-roadway travel to one and a half lanes.

Snowmobile routes and areas currently designated in the CFR but no longer open because of prior park management decisions include Spread Creek Road, Lizard Creek Campground Road, and the Potholes-Baseline Flats area.

### **2.2.3 John D. Rockefeller, Jr., Memorial Parkway**

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*Snowmobiling through the Parkway is generally transit oriented as people use Parkway snowmobile routes as access routes to YNP from routes outside the park boundary.*

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Snowmobiling through the Parkway is generally transit oriented as people use Parkway snowmobile routes as access routes to YNP from routes outside the park boundary. Within the Parkway boundary, the two snowmobile routes currently designated in the CFR through the 2002–2003 winter season are both groomed for oversnow travel (see Figure 2-2). The first, Grassy Lake Road, traverses 7 miles from its origin at Flagg Ranch to the western park boundary (described as the Ashton-Flagg Ranch Road in Section 1.1.2). This route continues west beyond the Parkway boundary into the Targhee National Forest. The second shorter snowmobile route is the 2-mile section of the Parkway (U.S. Highway 89-287) connecting Flagg Ranch with YNP's southern boundary. As described above, Flagg Ranch is a major staging area for winter activities in YNP, and the area provides a number of visitor services including a ranger station, food, lodging, and gasoline. Although not designated as permitted for use in the CFR until the winter use season 2002–2003, snowmobiles are currently permitted on the CDST in the Parkway southward from Flagg Ranch to GTNP's northern boundary, which includes approximately 4 miles of trail.

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## **2.3 SNOWMOBILE TRAIL ACCESS, MAINTENANCE, AND ENFORCEMENT**

### **2.3.1 Yellowstone National Park**

Snowmobiles are permitted on the designated routes in YNP after these areas have been closed to other vehicular traffic. Roads are officially opened by the park to snowmobiling between mid-December and mid-March, depending on snow conditions. Up-to-date access information is posted in several places including the park's web site, local news releases and information boards, local chambers of commerce, and an automated park information phone line. Winter closures are implemented in mid-March to allow plowing of park roads in preparation for the summer season (so that, weather permitting, all roads are passable by Memorial Day weekend) and to protect grizzly bears as they emerge from their dens. In the 2000–2001 winter season, designated trails were opened to snowmobiles on December 18, 2000, and closed to



oversnow vehicles on March 11, 2001 (although the west entrance closed on February 26 and the north entrance closed on March 4).

Park operations and maintenance personnel groom 184.6 miles of park roads and plow 56 miles in YNP. About 37 miles of groomed nonmotorized trails are provided in the park. These trails are near Mammoth, Canyon Tower, Virginia Cascades, Blacktail Plateau, East Entrance, and Old Faithful.

As part of their regular activities, park rangers provide a range of emergency services to park visitors including providing fuel, equipment repairs, minor first aid or directions, medical services, and search and rescue. Park rangers also provide agency assists, incidents in which NPS employees are contacted by the public safety departments from surrounding jurisdictions outside the park to provide assistance with situations such as search and rescue or incidents involving wildlife associated with the park.

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*Incidents in YNP that involve either general ranger support or law enforcement incidents involve a disproportionate number of snowmobilers relative to total winter visitors.*

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Incidents in the park that involve either general ranger support or law enforcement incidents involve a disproportionate number of snowmobilers relative to total winter visitors. Eighty-eight percent of the citations issued in YNP between December and March from 1995 to 2001 were issued to snowmobilers. The general categories of citations issued to snowmobilers in the park, from most to least common, were for speeding, driving without a license or allowing another to do so, off-road travel, unsafe operations, traffic violations, and entering closed areas. In the same time period, 90 percent of case incident reports (CIR), which are submitted for some law enforcement violations as well as other general ranger support, involved snowmobiles, whereas snowmobiles accounted for only 62 percent of overall winter use. Unlike citations and CIRs, emergency medical services over the same period of time indicate that aid to snowmobilers was close to proportional to their overall numbers—62 percent of all reports were for snowmobilers, (NPS, 2002). The increase in motorized and nonmotorized winter use over the past 10 years has been accompanied by an increase in reported accidents. Generally, the number of snowmobile accidents in YNP has increased as snowmobile visitation has increased, but the incidence of motor vehicle accidents between December and March from 1995 to 2001 involving snowmobiles (65%) was close to proportional to their overall numbers (NPS,

2002).<sup>1</sup> In the winter seasons between 1991 and 2001, eight fatalities from snowmobile accidents occurred; two of these were in 1999.

Park staff has reported that snowmobile trespass occurs in the southwest side of the park adjacent to national forest land. Because this area is remote to the more visible and highly staffed areas of the park, enforcing no-enter zones is difficult in that area. Park staff anticipates that trespassing will continue in that area if snowmobile access in other parts of the park is restricted.

Implementation of snowmobile regulations requiring increased interpretative staff to provide for improved visitor services would require more resources. Otherwise, staffing is not expected to increase over present levels.

### **2.3.2 Grand Teton National Park and John D. Rockefeller, Jr., Memorial Parkway**

Snowmobiles are permitted on the designated routes in GTNP, as described in Sections 2.2.2 and 2.2.3, after these areas have been closed to other vehicular traffic. Roads are officially opened by the park to snowmobiling between mid-December and mid-March, depending on snow conditions. Up-to-date access information is posted in several places including the park's web site, local news releases and information boards, local chambers of commerce, and an automated park information phone line.

Approximately 36 miles of motorized trails are groomed in GTNP and the Parkway. The CDST is a groomed snowmobile trail constructed during winter that parallels the roadway from Moran to the northern edge of the park and further north to Flagg Ranch. All other oversnow trails in GTNP are ungroomed.

Thirteen miles of road within the Parkway boundary comprise the two groomed routes open to oversnow vehicles in the Parkway: Grassy Lake Road and the 2-mile section of the Parkway (U.S. Highway 89-287) connecting Flagg Ranch with the south boundary of YNP. The roadway is plowed south of Flagg Ranch to GTNP, and groomed snowmobile traffic is allowed adjacent to the road (on the CDST).

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<sup>1</sup> This percentage excludes motor vehicle accidents that occurred on US Highway 191.

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*Unlike in YNP, there are a great many more wheeled vehicles in the GTNP and the Parkway than snowmobiles. Accordingly, the relative number of incidents in the park involving wheeled vehicles is much higher.*

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As part of their regular activities, park rangers provide a range of services to park visitors including providing fuel, equipment repairs, minor first aid or directions, emergency medical services, and search and rescue and agency assists.

Unlike in YNP, there are a great many more wheeled vehicles in the GTNP and the Parkway than snowmobiles. Accordingly, the relative number of incidents in the park involving wheeled vehicles is much higher. A total of 299 citations were issued to winter recreationalists, including wheeled-vehicle touring and snowmobiling in the GTNP and the Parkway during the winter seasons from 1995–2001. Twenty-three percent of the violations involved snowmobiles. The general categories of incidents that were cited, from most to least common, were off-road travel or entering closed areas, unsafe operation, traffic violations, speeding, and allowing a driver to operate without a license. In the same time period, only approximately 12 percent of CIR involved snowmobiles. Of the Emergency Management System reports filed between December and March 1995 and December and March 2001, 27 percent were for snowmobiles (NPS, 2002).

Implementation of the regulation restricting or banning snowmobile use in the parks is unlikely to significantly increase or decrease NPS resources spent in the park because the monitoring of snowmobile activity in the park is currently incidental to other administrative activities.

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## **2.4 VISITATION DATA**

An analysis of the social benefits and costs of snowmobile use under the delay rule in YNP, GTNP, and the Parkway is presented in Section 3. To support the development of these estimates, this section presents historical data and projected baseline winter use as well as a discussion of the methodology used to generate the projections. The baseline presented in this section represents visitation to YNP, GTNP, and the Parkway prior to implementation of the January 2001 rule restricting snowmobile use. The expected effects of both the January 2001 rule and the delay rule are discussed in Section 3.

### 2.4.1 YNP, GTNP, and the Parkway Total Visitation Data

Total annual recreational visitation in 2000 to YNP was 2,838,233, 2,590,624 in GTNP, and 1,210,790 on the Parkway. Table 2-1 provides a month-by-month breakdown of visitation for recreational visits.<sup>2</sup> Table 2-2 presents the figures for winter use for the four winter entrances to YNP and for GTNP (which includes the Parkway), where winter is defined as December to March. In 2000–2001, winter use was 138,792 in YNP and 211,700 in GTNP. The majority of winter users in YNP enter through the north and west entrances (the towns of Gardiner and West Yellowstone, Montana, respectively).

**Table 2-1. Recreational Visitation to YNP, GTNP, and the Parkway, 2000**

Month	YNP	GTNP	The Parkway
January	37,301	56,329	13,514
February	47,573	55,986	15,394
March	20,404	49,764	11,252
April	27,869	51,355	2,512
May	214,814	170,039	67,465
June	553,892	501,849	265,652
July	768,040	632,865	361,503
August	634,104	510,035	232,326
September	353,728	329,923	169,603
October	139,784	132,501	60,073
November	13,422	58,504	5,208
December	27,302	41,474	6,288
Total	2,838,233	2,590,624	1,210,790

Source: NPS visitation records.

<sup>2</sup>A recreational visit is defined as the “entry of a person onto lands or waters administrated by the NPS for recreational purposes” (NPS, 1999). Recreational visits do not include “non-recreational” visits (defined as “through traffic, trades people with business in the park, and government personnel [other than NPS employees] with businesses in the park”) (NPS, 1999).

**Table 2-2. Winter Recreational Visitors in YNP and GTNP, 1996-2001**

Winter	YNP					GTNP
	North	West	South	East	Total	
1996–97	34,902	56,069	19,272	3,212	113,455	162,627
1997–98	40,497	54,859	20,486	3,432	119,274	176,601
1998–99	41,007	59,928	20,385	2,889	124,209	180,367
1999–00	42,903	58,154	22,957	3,366	127,380	223,944
2000–01	43,226	66,468	24,718	4,380	138,792	211,700

Source: NPS visitation records.

### 2.4.2 Winter Use Activities Data

*Snowmobile passengers made up at least 60 percent of winter users in YNP in the past five winter seasons. The majority of these users entered through the west entrance.*

In Table 2-3, winter visitation in 1996–2001 is broken down by activity for YNP. Snowmobile passengers made up at least 60 percent of winter users in YNP in the past five winter seasons. Tables 2-4 through 2-7 present the figures for each entrance individually. In the winter in YNP, only the north entrance is open to cars (see Table 2-4). At this entrance, only about 4 percent of winter visitors arrived on snowmobiles in 2000–2001 (the most recent winter season for which data were available by winter use category for YNP and GTNP), while 89 percent arrived by car. In contrast, at the other entrances the majority of visitors arrived by snowmobile. As indicated in Table 2-5, 58,292 snowmobile riders entered YNP through the west entrance in 2000–2001, nearly 69 percent of the total number of snowmobile passengers entering YNP that year. The east entrance was the least used of the four winter entrances. As indicated in Table 2-6, only 4,380 people entered in the winter of 2000–2001, and 96 percent of these visitors (4,183 people) were riding snowmobiles. Finally, as indicated in Table 2-7, the south entrance received the second highest number of snowmobile riders entering the park during the winter season of 2000–2001. There were 20,738 people, or 24 percent of the total number of snowmobile riders in YNP, that entered through the south entrance. Estimating the annual number of cross-country skiers in YNP is more difficult. Statistics from entrance booths only count the number of skiers who ski into YNP. Most cross-country skiers use other means of transportation to reach trail heads within the park. According to surveys by Littlejohn (1996) and Duffield and Neher (2000), approximately 20 percent of visitors participate in cross-country skiing in the park during their trips to YNP.

Table 2-8 provides the breakdown in winter activities for GTNP and the Parkway. Of the 211,700 visitors who entered GTNP (including the Parkway) in winter 2000–2001 (see Table 2-2), only 42,845 entered the park on a snowmobile, snowplane, or skis. The remainder entered the park in wheeled vehicles, primarily automobiles. In the winter, GTNP is much more accessible to wheeled vehicles than YNP. In YNP, wheeled vehicles can only enter through the North entrance. However, in GTNP, there are far more plowed roads in GTNP and wheeled vehicles can enter the park at several entrances. Total snowmobile use from the Parkway, the CDST, and GTNP was 34,936 visitors in the winter of 2000–2001. Note, however, that these visitors are not mutually exclusive of those counted entering YNP’s south entrance. Of the 34,936 snowmobile visitors in the Parkway, CDST, and GTNP, NPS estimates that the majority also entered YNP at the south entrance. Based on an assumption that 100 percent of snowmobilers counted at the south entrance of YNP were also included in visitation counts in GTNP or the Parkway, about 20,738 visitors in 2000–2001 would have been double-counted.

**Table 2-3. Combined Winter Use Activities for All Four Entrances in YNP**

Winter Season	Visitors by Auto <sup>b</sup>	Recreational Vehicle Passengers <sup>b</sup>	Bus Passengers <sup>b</sup>	Skiers <sup>a</sup>	Snowmobile Passengers	Snowcoach Passengers	Total Visitors
1996–97	30,432	129	429	485	71,759	10,221	113,455
1997–98	35,704	81	305	453	72,834	9,897	119,274
1998–99	36,450	90	173	446	76,271	10,779	124,209
1999–00	37,872	140	747	351	76,571	11,699	127,380
2000–01	38,538	139	3071 <sup>c</sup>	390	84,971	11,683	138,792

<sup>a</sup>Numbers of skiers reflect the number of visitors that actually skied through the entrance gate. It does not reflect the number of visitors that access the park via another mode of transportation and then ski in the park interior. Visitor surveys indicate about 20 percent of visitors skied in the park (Littlejohn, 1996; Duffield and Neher, 2000).

<sup>b</sup>Only the north entrance is open to cars, recreational vehicles, and buses in the winter.

<sup>c</sup>Includes 2,528 bus passengers who traveled through the West Entrance during March 2001 who were counted as snowcoach passengers.

Source: NPS visitation records.

**Table 2-4. Winter Use Activities in YNP—North Entrance**

Winter Season	Visitors by Auto <sup>a,b</sup>	Recreational Vehicle Passengers	Bus Passengers	Skiers <sup>c</sup>	Snowmobile Passengers	Snowcoach Passengers	Total Visitors
1996–97	30,432	129	429	21	2,080	1,811	34,902
1997–98	35,704	81	305	10	2,119	2,278	40,497
1998–99	36,450	90	173	17	2,196	2,081	41,007
1999–00	37,872	140	747	21	1,617	2,506	42,903
2000–01	38,538	139	543	7	1,758	2,241	43,226

<sup>a</sup>Statistics for automobile visitors use for the entire months of December and March. For skiers, snowmobile riders, and snowcoach passengers, the winter season usually begins between December 15 and 20 and ends between March 10 and 15.

<sup>b</sup>Visitor surveys indicate that about 25 percent of all visitors who arrive by automobile also skied in the park (Littlejohn, 1996).

<sup>c</sup>Numbers of skiers reflect the number of visitors that actually skied through the entrance gate. It does not reflect the number of visitors that access the park via another mode of transportation and then ski in the park interior. Visitor surveys indicate about 20 percent of visitors skied in the park (Littlejohn, 1996; Duffield and Neher, 2000).

Source: NPS visitation records.

**Table 2-5. Winter Use Activities in YNP—West Entrance**

Winter	Skiers <sup>a</sup>	Snowmobile Passengers	Snowcoach Passengers	Total Visitors
1996–97	21	50,296	5,752	56,069
1997–98	18	49,776	5,065	54,859
1998–99	27	53,980	5,921	59,928
1999–00	21	52,575	5,558	58,154
2000–01	67	58,292	8,109 <sup>b</sup>	66,468

<sup>a</sup>Numbers of skiers reflect the number of visitors that actually skied through the entrance gate. It does not reflect the number of visitors that access the park via another mode of transportation and then ski in the park interior. Visitor surveys indicate about 20 percent of visitors skied in the park (Littlejohn, 1996; Duffield and Neher, 2000).

<sup>b</sup>This number includes 2,528 bus passengers from March (the road opened to mass transit vehicles on March 1, 2001).

Source: NPS visitation records.

**Table 2-6. Winter Use Activities in YNP—East Entrance**

Winter Season	Skiers <sup>a</sup>	Snowmobile Passengers	Snowcoach Passengers	Total Visitors
1996–97	355	2,857	0	3,212
1997–98	346	3,077	9	3,432
1998–99	263	2,620	6	2,889
1999–00	204	3,105	57	3,366
2000–01	197	4,183	0	4,380

<sup>a</sup>Numbers of skiers reflect the number of visitors that actually skied through the entrance gate. It does not reflect the number of visitors that access the park via another mode of transportation and then ski in the park interior. Visitor surveys indicate about 20 percent of visitors skied in the park (Littlejohn, 1996; Duffield and Neher, 2000).

Source: NPS visitation records.

**Table 2-7. Winter Use Activities in YNP—South Entrance**

Winter Season	Skiers <sup>a</sup>	Snowmobile Passengers	Snowcoach Passengers	Total Visitors
1996–97	88	16,526	2,658	19,272
1997–98	79	17,862	2,545	20,486
1998–99	139	17,475	2,771	20,385
1999–00	105	19,274	3,578	22,957
2000–01	119	20,738	3,861	24,718

<sup>a</sup>Numbers of skiers reflect the number of visitors that actually skied through the entrance gate. It does not reflect the number of visitors that access the park via another mode of transportation and then ski in the park interior. Visitor surveys indicate about 20 percent of visitors skied in the park (Littlejohn, 1996; Duffield and Neher, 2000).

Source: NPS visitation records.

**Table 2-8. Winter Use Activities in GTNP and the Parkway**

Winter Season	The Parkway Snowmobile	CDST Snowmobile	GTNP Snowmobile	GTNP Snowplane	The Parkway Skiing	GTNP Skiing	Total Visitors <sup>a</sup>
1996–97	19,024	2,779	3,843	1,790	1,440	1,636	30,512
1997–98	17,589	2,318	4,051	1,685	1,373	1,577	28,593
1998–99	17,110	2,304	3,617	851	1,169	1,298	26,349
1999–00	23,399	1,329	2,867	1,091	1,581	5,387 <sup>b</sup>	35,654
2000–01	31,011	1,307	2,618	1,148	1,987	4,774	42,845

<sup>a</sup>This total does not include those visitors entering GTNP in wheeled vehicles.

<sup>b</sup>Reason for increase in skier numbers unknown.

Source: NPS visitation records.



### **2.4.3 Projected Winter Use**

To project winter visitation through 2011–2012, NPS used annual growth rates based on information obtained from park staff and a YNP transportation report projecting total park visitation through 2010 (BRW, 1997). In addition, NPS combined all categories of winter use into five groups: snowmobile, snowcoach (YNP only), snowplane (GTNP only), cross-country skier, and other visitors, for the projections. The primary focus of the analysis is on the impacts to snowmobilers vs. non-snowmobilers, but it is useful to break winter use into additional categories to evaluate the impacts on local businesses providing different services and to reflect different valuations across winter activities.

Table 2-9 summarizes the winter use projections for YNP, prior to implementation of the January 2001 rule. The growth rate is assumed to be positive through 2011–2012, although declining over time (BRW, 1997). Because some visitors engage in multiple activities on the same trip, total visitation is not equal to the sum of the four winter use categories presented in Table 2-9. For instance, due to limited access to the park for wheeled vehicles (wheeled vehicles can only enter through the North entrance), many visitors use snowmobiles or snowcoaches to reach their skiing destinations. For the purposes of this analysis, NPS assumed that 8 percent of snowmobilers and 50 percent of snowcoach riders also went skiing on the same trip (based on data gathered by Duffield and Neher, 2000). It was also assumed that approximately 20 percent of visitors to YNP went cross-country skiing in the park, based upon studies by Littlejohn (1996) and Duffield and Neher (2000). Thus, total visitation is the sum of the snowmobile, snowcoach, and other visitors categories plus cross-country skiing visitation minus 8 percent of snowmobilers minus 50 percent of snowcoach riders. Similarly, Table 2-10 summarizes projected winter visitation for GTNP (including the Parkway), prior to implementation of the January 2001 rule. The share of visitors that cross-country ski was estimated to be 30 percent of total visitation based on personal communication with GTNP staff. Also, the other visitors category is a much larger percentage of visitation for GTNP than YNP in part because GTNP is much more accessible to wheeled vehicles. This makes it far easier to travel through the park without a motorized oversnow vehicle. In addition, GTNP is a more popular destination

**Table 2-9. Projected Winter Use Activities in YNP, 2001–2002 through 2011–2012**

Winter Season	Snowmobile	Snowcoach	Cross-Country Ski	Other Visitors	Total Visitors <sup>a</sup>	Growth Rate <sup>b</sup>
2001–02 <sup>c</sup>	86,227	11,832	28,304	28,019	141,568	2.0%
2002–03	87,779	12,045	28,814	28,524	144,116	1.8%
2003–04	89,271	12,250	29,303	29,008	146,566	1.7%
2004–05	90,610	12,433	29,743	29,444	148,765	1.5%
2005–06	91,879	12,608	30,159	29,856	150,847	1.4%
2006–07	93,073	12,771	30,551	30,244	152,808	1.3%
2007–08	94,190	12,925	30,918	30,607	154,642	1.2%
2008–09	95,226	13,067	31,258	30,944	156,343	1.1%
2009–10	96,179	13,198	31,571	31,253	157,906	1.0%
2010–11	97,044	13,316	31,855	31,534	159,328	0.9%
2011–12	97,821	13,423	32,110	31,787	160,602	0.8%

<sup>a</sup>The sum of the four winter use categories is not equal to total visitation because visitors who engage in multiple activities are being double-counted. For example, many visitors ride snowcoaches or snowmobiles to reach areas of the park where they can go cross-country skiing. Based on data gathered by Duffield and Neher (2000), NPS assumed that 8 percent of snowmobilers and 50 percent of snowcoach riders are also cross-country skiing on the same trip. Thus, total visitation is equal to the sum of the snowmobile, snowcoach, and other categories plus the cross-country skier category minus 8 percent of snowmobilers minus 50 percent of snowcoach riders.

<sup>b</sup>The growth rates through 2010–2011 come from a YNP transportation study by BRW (1997). The 2011–2012 growth rate was assumed based on the trend in growth rates from 2001–2002 through 2010–2011.

<sup>c</sup>Visitation data by winter use category were not available for 2001–2002 when this report was written.

than YNP for nonmotorized recreation such as snowshoeing. The annual growth rate in winter visitation is expected to be higher for GTNP than YNP over the next 10 years based on information provided by park staff. GTNP staff estimate that growth will likely be between 3 to 5 percent annually and that the rate of growth may decline slightly over time. NPS assumed that the growth rate would decline in equal increments from 4.5 to 3.5 percent annual growth between 2001–2002 and 2010–2011. The number of snowmobilers, cross-country skiers, and total visitors was projected for each year based on the assumed growth rates. In contrast to the relatively large annual increases expected in these categories, snowplane use was assumed to be declining by 2 percent per year based on recent trends. The number of visitors in the other visitors category was calculated by subtracting the number of snowmobilers, snowplane users, and cross-country skiers from total visitation.

**Table 2-10. Projected Winter Use Activities in GTNP, 2001–2002 through 2011–2012**

Winter Season	Snowmobile	Snowplane	Cross-Country Ski	Other Visitors	Total Visitors <sup>a</sup>	Growth Rate <sup>b</sup>
2001–02 <sup>c</sup>	36,508	1,125	66,368	117,225	221,227	4.5%
2002–03	38,114	1,103	69,288	122,455	230,960	4.4%
2003–04	39,753	1,080	72,268	127,790	240,892	4.3%
2004–05	41,423	1,059	75,303	133,225	251,009	4.2%
2005–06	43,121	1,038	78,390	138,751	261,301	4.1%
2006–07	44,846	1,017	81,526	144,364	271,753	4.0%
2007–08	46,595	997	84,705	150,054	282,351	3.9%
2008–09	48,366	977	87,924	155,814	293,080	3.8%
2009–10	50,155	957	91,177	161,634	303,924	3.7%
2010–11	51,961	938	94,460	167,507	314,866	3.6%
2011–12	53,780	919	97,766	173,421	325,886	3.5%

<sup>a</sup>Unlike YNP, total visitation for GTNP is equal to the sum of the four categories included for this park. Because visitors can more easily drive into the park and snowcoaches are not used in GTNP, it is much less likely that visitors would use transportation other than wheeled vehicles to reach their skiing destination in the park. Therefore, NPS assumed that those users counted as snowmobilers or snowplane users would not use their vehicles in order to reach a destination for skiing. Based on personal communication with GTNP staff, NPS assumed that about 30 percent of all visitors go cross-country skiing in the park.

<sup>b</sup>The growth rates for GTNP are based on personal communication with park staff, who indicated that overall winter visitation growth in the park was likely to be in the neighborhood of 3 to 5 percent annually over the next 10 years, similar to the average annual increases that YNP experienced in the 1980s and early 1990s. NPS assumed that annual growth would be higher at the beginning of the period, with growth slowing slightly over time (although remaining fairly high). These growth rates were applied to cross-country skiers, snowmobilers, and total visitation, while snowplane use was assumed to decline by 2 percent annually based on recent reductions in snowplane use. The other visitors category was calculated by subtracting cross-country skiers, snowmobilers, and snowplane users from total visitation.

<sup>c</sup>Visitation data by winter use category were not available for 2001–2002 when this report was written.

The projections in Tables 2-9 and 2-10 are used as the basis for estimating the impacts of the delay rule in Section 3. First, these projections are adjusted to reflect the effects of implementing the January 2001 restrictions on snowmobile and snowplane use in YNP, GTNP, and the Parkway. Then, the incremental impacts of the delay rule are calculated using the difference in visitation for each winter use category under the January 2001 rule and the delay rule. Although winter visitation was projected through 2011–2012, the delay rule only has incremental impacts in 2002–2003 and 2003–2004. Starting with 2004–2005, the snowmobile restrictions would be identical under the January 2001 rule and the delay rule.

#### 2.4.4 Sources of Uncertainty in Visitation Projections

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*Although winter visitation was projected through 2011–2012, the delay rule only has incremental impacts in 2002–2003 and 2003–2004. Starting with 2004–2005, the snowmobile restrictions would be identical under the January 2001 rule and the delay rule.*

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NPS estimates of winter visitation for the seasons 2001–2002 through 2011–2012 are based on the best information available from local park staff. However, a variety of unpredictable circumstances could impact visitation in any particular year. Although visitation to these parks has been growing over time in recent years, visitation has displayed some large variability from one year to the next. In general, visitation in a specific year will depend on many factors, including

- economic conditions;
- weather;
- natural resource conditions;
- national and state regulations that may affect snowmobile use or prices; and
- alternative recreational activities available.

It is also possible that publicity surrounding the proposed NPS snowmobile restrictions may have had an impact on snowmobile use in recent years. Snowmobile use in YNP has increased significantly since 1999–2000, possibly reflecting snowmobilers' desire to travel to YNP before any new restrictions on snowmobiles go into effect. Thus, it is possible that the projections based on annual growth rates with 2000–2001 snowmobile use as the baseline may overstate what future snowmobile visitation would have been without additional regulations.

In addition, it was necessary to make assumptions regarding the distribution of visitors between use types in future years. For instance, it was generally assumed that visitation would change at an equal rate across winter use categories (although there are exceptions, such as snowplane use). However, it is quite possible that some use categories would grow faster than others. Also, many ratios calculated using historical data or surveys (e.g., average number of people per snowmobile, percentage of snowmobiles that are rentals, percentage of rented snowmobiles that are guided, percentage of visitors that cross-country ski) were assumed to remain constant in future years. To the extent that these ratios change over time, the projections may overstate or understate visitation by visitors in any particular winter use category.

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## **2.5 ALTERNATE LOCATIONS FOR SNOWMOBILING NEARBY**

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*In addition to the three national park units, the GYA includes six national forests, all of which offer recreational snowmobiling opportunities.*

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Wyoming, Montana, and Idaho all have well-established recreational snowmobiling areas. In total, these three states offer more than 12,900 miles of groomed trails, as well as hundreds of miles of ungroomed trails and thousands of acres for off-trail riding. In addition to the three national park units, the GYA includes six national forests, all of which offer recreational snowmobiling opportunities: Gallatin, Beaverhead-Deerlodge, Caribou-Targhee, Bridger-Teton, Shoshone, and Custer. Snowmobiling in the neighboring forest areas and nearby communities is described in more detail below.

Custer National Forest abuts the northeast border of YNP. Only the Beartooth Ranger District of the Custer National Forest lies within the GYA. Portions of the Beartooth Ranger District of the Custer National Forest are open to oversnow motorized travel, particularly along the Beartooth highway. The Wyoming Division of State Parks and Historic Sites states that spectacular scenery highlights the link between Cooke City and Red Lodge, Montana.

The Gallatin National Forest contains more than 135 miles of groomed trails that are directly accessible from West Yellowstone and provide numerous opportunities for wildlife viewing. The most renowned of all the West Yellowstone trails is the 110-mile Big Sky Trail north of West Yellowstone. Much of this trail is ungroomed

with fields of snow up to 28 feet deep and numerous hill-climbing opportunities. In addition, routes originate from the Cooke City, Montana area that provide access to snow play areas and connect to Custer Forest trails.

West Yellowstone, Montana, has been characterized as the “Snowmobiling Capital of the World” because it averages over 150 inches of snow each year; provides access to over 400 miles of groomed trails in the surrounding national forests (the Gallatin, Beaverhead-Deerlodge, and Targhee); and serves as a gateway for snowmobiling in YNP, GTNP, and the Parkway. Beaverhead-Deerlodge National Forest in southwest Montana is the largest national forest in the state and includes nearly 600 miles of groomed and ungroomed snowmobile trails. The Madison Ranger District of this forest near YNP includes over 100 miles of these trails and extensive backcountry snowmobiling areas. The Island Park District of the Targhee National Forest offers 391 miles of groomed trails and includes scenic highlights such as Upper and Lower Mesa Falls, offering dramatic glimpses of the Island Park caldera’s edge. Groomed snowmobile trails in the Island Park, Idaho, area total 500 miles, and the region also includes dozens of meadows, rolling hills, and hill-climbing opportunities. Trails in this area connect Ashton, Idaho, to West Yellowstone to the north, to St. Anthony to the south, and to Flagg Ranch in the Parkway to the east. The Dubois District of the Caribou-Targhee has no groomed trails, but portions of the district are open to snowmobiles.

The eastern borders of YNP and GTNP include the Shoshone and Bridger-Teton National Forests. Over 280 miles of scenic groomed and ungroomed trails, plus thousands of acres of off-trail riding, are open to snowmobiles in the Shoshone National Forest. In the Bridger-Teton, there are approximately 700 miles of groomed snowmobiles trails, as well as 100 miles of ungroomed trails and extensive backcountry areas open to snowmobiles. The Shoshone, with YNP on its western border, encompasses the area from the Montana state line south to Lander, Wyoming. The western boundary of the forest south of Yellowstone is the crest of the Continental Divide. Elevations on the Shoshone range from 4,600 feet at the mouth of Clarks Fork Canyon to 13,804 feet atop Gannett Peak, Wyoming’s highest. In the Beartooth Mountains, in the northern half of the Shoshone Forest on the southeastern border

of YNP, snowmobiles may travel approximately 36 miles of groomed and 34 miles of ungroomed trails. Historically the Buffalo Bill Scenic Byway, 50 miles west of Cody, has provided access from the forest to YNP.

A variety of snowmobile trails connect the southern portion of the Shoshone with the Bridger-Teton National Forest, including stretches of the CDST. The CDST generally parallels the Continental Divide between Lander, Wyoming, and YNP's south entrance. The distance between Lander and the eastern border of GTNP is approximately 235 miles. The Lander area has 118 miles of groomed trails through scenic-forested mountains. The CDST between Lander and Pinedale, Wyoming, into the Bridger-Teton National Forest, is described as varied, with high mountains, scenic views, and visibilities of up to 150 miles. Snowmobiles are permitted in the town of Pinedale itself, through which the CDST travels. The Pinedale area trail system through the Wind River and Wyoming Mountain Ranges includes 141 miles of trail through open country with numerous scenic mountain views. The CDST continues from Dubois and onto the eastern GTNP border just beyond Togwotee Pass. As described by the Wyoming Division of State Parks and Historic Sites, the "Dubois area boasts some of the best and most scenic riding in the world on 150 miles of beautiful trails and thousands of acres of off-trail riding." Beyond Dubois is the Togwotee area, described by some local retailers as a spectacular snowmobiling mecca, offering unparalleled terrain and powder made for snowmobiling.

The Gros Ventre Mountain Range area within the Bridger-Teton National Forest just southeast of GTNP has approximately 57 miles of groomed trail just east of the Tetons. This trail system provides access to the Togwotee, Dubois, and Pinedale snowmobiling areas from Jackson. Although snowmobiling in this area is restricted to the trail in most places because of wildlife concerns, it offers the possibility of viewing elk, moose, deer, mountain sheep, coyotes, or bobcats. In the southern portion of the Bridger-Teton National Forest, the Wyoming Range between Alpine and Kemmerer, Wyoming, has approximately 335 miles of groomed trails and numerous opportunities for off-trail riding.

## **2.6 OTHER MAJOR WINTER ACTIVITIES**

### **2.6.1 Yellowstone National Park**

Winter activities within YNP, other than snowmobiling, include auto-touring, snowcoach touring, wildlife viewing, cross-country and telemark skiing, snowboarding, snowshoeing, and winter camping. Ranger-led winter activities in YNP include interpretative programs, winter wildlife tours (via bus), and snowshoe walks.

Snowcoach tours in YNP operate from Mammoth Hot Springs, West Yellowstone, Old Faithful, and Flagg Ranch (in the Parkway). Snowcoaches provide access to cross-country skiing, snowshoeing tours, and sightseeing tours.

Nonmotorized travel, such as cross-country skiing and snowshoeing, is permitted throughout YNP except in the Grand Canyon of the Yellowstone and McMinn Bench. Skiers and snowshoers are permitted on designated snowmobile routes within YNP. In addition, the park has approximately 37 miles of groomed nonmotorized trails located near Mammoth Hot Springs, Virginia Cascades east of Norris Junction, Old Faithful, the east entrance, Canyon Village, Tower-Roosevelt, and the Blacktail Plateau.

### **2.6.2 Grand Teton National Park**

Winter activities in GTNP other than snowmobiling include auto-touring and wildlife viewing, snowplaning, cross-country skiing, snowshoeing, and ice fishing. Snowplanes are permitted on Jackson Lake. Skiers and snowshoers are permitted on designated snowmobile routes within GTNP. The area around Jackson Lake, although open to snowmobilers, is popular among snowplane operators, cross-country skiers, and snowshoers.

Nonmotorized travel, such as cross-country skiing and snowshoeing, is permitted throughout GTNP except in the Snake River bottom from Menor's Ferry at Moose north to Moran Junction; at the Buffalo Fork of the Snake River within the park; and within Willow Flats, Kelly Hill, Uhl Hill, and Wolf Ridge. Ungroomed ski and snowshoe trails, totaling approximately 26 miles, are available from Taggart Lake Trailhead to both Taggart and Jenny Lakes, along Antelope Flats Road, and near Moose, Death Canyon, Granite Canyon, Two Ocean Lake, and Colter Bay. Ski tours are periodically available from the Moose Visitor Center.



### **2.6.3 John D. Rockefeller, Jr., Memorial Parkway**

Snowcoaches operate from the lodge at Flagg Ranch but are dedicated to running tours into YNP, as opposed to the Parkway or GTNP. There are approximately 5.2 miles of ungroomed ski and snowshoe trails in the vicinity of Flagg Ranch. Furthermore, ski tours are occasionally available from Flagg Ranch.

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## **2.7 NATURAL RESOURCES AND LIKELY ECOLOGICAL IMPACTS OF SNOWMOBILE USE IN PARK**

Half of the known geothermal features in the world, including the largest concentration of geysers in the world, are located within the GYA. The parks protect the largest number and greatest variety of animal species in the lower 48 states.

### **2.7.1 Air Quality and Human Health**

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*Typical snowmobiles currently used (e.g., with carbureted two-stroke engines) release substantial amounts of pollutants into the environment. Air quality and visibility can be affected by emissions from two-stroke engines such as snowmobile engines.*

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Typical snowmobiles currently used (e.g., with carbureted two-stroke engines) release substantial amounts of pollutants into the environment. Air quality and visibility can be affected by emissions from two-stroke engines such as snowmobile engines.<sup>3</sup> The typical conventional (i.e., carbureted) two-stroke engine intakes a mixture of air, gasoline, and oil into the combustion chamber, and expels exhaust gases from the combustion chamber. The three primary reasons for emission releases are:

- up to one-third of the fuel delivered to the engine is expelled without being burned,
- lubricating oil is mixed with fuel and thus is expelled as part of the exhaust, and

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<sup>3</sup>In the final rule signed on September 13, 2002, EPA has adopted “fleet-averaged” carbon monoxide (CO) and hydrocarbon (HC) emissions standards for snowmobiles, effective in three phases. In Phase 1, 50% of new snowmobiles sold will be required to meet the following emissions standards in 2006: 275 g/kW-hr (205 g/hp-hr) for CO and 100 g/kW-hr (75 g/hp-hr) for HC. Phase 1 requires 100% compliance to these standards for new machines in the 2007 model year. In Phase 2 standards are further reduced effective the 2010 model year: 275 g/kW-hr for CO and 75 g/kW-hr for HC. The final standards (Phase 3) are to be implemented by 2012: 200 g/kW-hr (149 g/hp-hr) for CO and 75 g/kW-hr (56 g/hp-hr) for HC. Phase 3 will also establish a cap on nitrogen oxides (NO<sub>x</sub>). These standards represent 30 percent (in 2006) and 50 percent (in 2012) reductions in HC and CO emissions from the current average baseline levels. No standards for particulate matter (PM) were included in the rule “because limits on HC emissions will serve to simultaneously reduce PM” (EPA, 2002).

- the combustion process results in high emissions of air pollutants.

Contaminants released into the environment due to snowmobile use include those present in the raw fuel itself and those that are formed during its combustion. Fuel used in conventional two-stroke engines contains many hydrocarbons (HCs), including volatile organic compounds (VOCs) such as benzene, toluene, ethylbenzene, and xylene (collectively referred to as BTEX), methyl tertiary butyl ether (MTBE) and polycyclic aromatic HCs (PAHs), nitrogen oxides (NO<sub>x</sub>), particulate matter (PM), and carbon monoxide (CO) (Kado et al., 2000). Unburned fuel does not contain appreciable levels of PAHs, but several PAHs are formed as a result of its combustion (i.e., phenanthrene, pyrene, chrysene/benzo(a)pyrene, and acenaphthylene) (VanMouwerik and Hagemann, 1999). Other HCs that are not present in fuel but are by-products of incomplete combustion include formaldehyde, acetaldehyde, diesel PM, and 1,3-butadiene (EPA, 1994). Two-stroke engines also contribute to the formation of ozone in the atmosphere, which is formed when HCs react with NO<sub>x</sub> in the presence of sunlight (EPA, 1993).

Inhalation of many of these pollutants is associated with a wide variety of potential adverse health effects (Table 2-11). When carbon monoxide enters the bloodstream, it reduces the delivery of oxygen to the body's organs and tissues. Health effects may include impairment of visual perception, manual dexterity, learning ability, and performance of complex tasks; headaches and fatigue; or respiratory failure and death. Health effects from PM emissions may include reduced lung function, aggravation of respiratory ailments, long-term risk of increased cancer rates, and development of respiratory problems.

The extent to which the health effects listed in Table 2-11 result from snowmobile emissions depends on the level and duration of exposure. Unfortunately, there is too little data and too much uncertainty to reliably estimate the incidence of these health effects. For comparative purposes, however, Table 2-12 compares emissions rates of HCs and CO for snowmobiles and for other vehicles.

**Table 2-11. Health Effects Associated with Pollutants Found in Snowmobile Emissions**

	<b>Carcinogenic Effects</b>	<b>Other Chronic Health Effects</b>	<b>Acute Health Effects</b>
Particulate matter (PM)	None	Chronic bronchitis	High-level exposure: mortality, acute bronchitis Low-level exposure: cough
Carbon monoxide (CO)	None	Aggravation of cardiovascular disease	High-level exposure: visual and mental impairment
Nitrogen oxides (NO <sub>x</sub> )	None	Reduced pulmonary function	High-level exposure: cough, fatigue, nausea Low-level exposure: lung irritation
Benzene	Known human carcinogen	Anemia and immunological disorders	High-level exposure: dizziness, headaches, tremors
1,3-Butadiene	Probable human carcinogen	Birth defects, kidney and liver disease	High-level exposure: neurological damage, nausea, headache Low-level exposure: eye, nose, throat irritation
Formaldehyde	Probable human carcinogen	NA	NA
Acetaldehyde	Possible human carcinogen	Anemia	High-level exposure: pulmonary edema, necrosis Low-level exposure: eye, skin, lung irritation
Ammonia	None	NA	High-level exposure: eye and lung irritation

NA = Not available.

Sources: U.S. Environmental Protection Agency (EPA). Integrated Risk Information System.

<<http://www.epa.gov/ngispgm3/iris/index.htm>>. As obtained on October 15, 2000a.

U.S. Environmental Protection Agency (EPA). 1999a. *1997 National Air Quality: Status and Trends*. Washington, DC: Office of Air and Radiation.

**Table 2-12. Comparative Emissions Factors for Snowmobiles and Other Vehicles: HC and CO**

	<b>HC</b>	<b>CO</b>
Snowmobiles (lbs per 4 hr visit)	19.84	54.45
Automobiles (lbs per 4 hr drive <sup>a</sup> )	0.09–0.44	0.75–3.24
Diesel buses (lbs per 4 hr drive <sup>a</sup> )	1.23	4.45

<sup>a</sup>Assuming an average speed of 25 mph.

Source: National Park Service (NPS). February 2000a. *Air Quality Concerns Related to Snowmobile Usage in National Parks*. Denver, CO.

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*National park visitors traveling on snowmobile trails may be exposed to particularly high levels of CO and certain HCs.*

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The comparisons for CO are particularly relevant since highway vehicles account for over 50 percent of total CO emissions in the country (EPA, 2000b). Although the measures of vehicle use in the emissions factors are different across vehicles, the rates of HC and CO emissions for snowmobiles are distinctly higher than for automobiles and diesel buses. As a result, national park visitors traveling on snowmobile trails may be exposed to particularly high levels of CO and certain HCs. For example, a study of air quality at entrance kiosks in Yellowstone's west entrance indicated that an hourly traffic count of 450 snowmobiles would likely result in concentrations above the 1-hour national ambient air quality standards (NAAQS) for CO (35 ppm).

### **Current Air Quality and Public Health Conditions in GYA Parks**

YNP and GTNP are classified as mandatory Class I areas under the Federal Clean Air Act (42 USC 7401 et seq.).<sup>4</sup> This air quality classification is aimed at protecting parks and wilderness areas from air quality degradation. The Parkway is a Class II area, but is managed as a Class I area under NPS policy.

Because there is little industrial activity and a relatively low population in northwestern Wyoming, overall regional air quality in the parks is good. All park areas are located in areas that are in attainment with all federal and state ambient air quality standards. The major sources of air pollutants in the area are those emitted by motor vehicles (automobiles, buses, snowcoaches, and snowmobiles) concentrated along motorized routes, and smoke from wood fires, including stoves, fireplaces, and campfires. The predominant fuels consumed by stationary sources in the parks are propane and number two heating oil.

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<sup>4</sup>The states of Montana and Wyoming have adopted some standards more stringent than the federal standards established by EPA under the Clean Air Act. The jurisdiction for enforcement of the national ambient air quality standards (NAAQS) is delegated to the states.

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*Over the past 10 years, increases in the number of visitors using snowmobiles in YNP, GTNP, and the Parkway have intensified concerns regarding air pollution and its effects on the health of park employees, visitors, and operators and riders of snowmobiles.*

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Snowmobile emissions have been the source of the vehicle emission and health-related complaints in YNP. For example, in 1993 and 1994 YNP received over 1,200 complaint letters concerning employee and visitor health and excessive snowmobile pollution. Over the past 10 years, increases in the number of visitors using snowmobiles in YNP, GTNP, and the Parkway have intensified concerns regarding air pollution and its effects on the health of park employees, visitors, and operators and riders of snowmobiles.

The highest potential threats to human health from snowmobile emissions occur during periods of poor air movement and/or peak visitation periods, such as the mid-morning hours Christmas week and on Presidents' Day weekend, particularly in high use areas such as the west entrance. Ambient concentrations of CO and PM at the west entrance station kiosk have been measured at levels that exceed federal ambient air quality standards (NPS, 2000a); however, these exceedances are usually very localized and of short duration.<sup>5</sup> The Occupational Safety and Health Administration (OSHA) found that an employee working the express lane, primarily outside the kiosk booth at the west entrance, was overexposed to benzene and formaldehyde, as an 8-hour time-weighted average, and overexposed to CO as a peak concentration (OSHA, 2001, as reported in NPS, 2002). Also, although it is not known which pollutants are directly responsible, NPS has received written complaints from several workers at this entrance indicating that they are much more likely to experience adverse acute symptoms such as nausea, headaches, and eye and throat irritation during peak visitation periods.

NPS (2002) has conducted extensive short-term air quality analyses using atmospheric modeling to assess the relative impacts of the winter use alternatives, including the no-action alternative (current conditions). Based on previous studies and the dispersion modeling, NPS concluded that current winter use activities lead to short-term adverse impacts at the west entrance during high winter use days. For example the predicted maximum 1-hour CO concentration at the west entrance was 32.2 ppm (Montana standard is 23 ppm) with snowmobiles contributing 97.9 percent;

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<sup>5</sup>These measurements do not necessarily constitute *violations* of the federal standards, due to sampling procedures and differences in averaging times.

the predicted maximum 24-hour  $PM_{10}$  concentration at the west entrance was  $68.2 \mu\text{g}/\text{m}^3$  (Montana standard is  $150 \mu\text{g}/\text{m}^3$ ) with snowmobiles contributing 99.3 percent.

Snowmobile emissions standards established by EPA will substantially reduce emissions of CO and HC associated with snowmobile use (30 and 50 percent reductions in HC and CO emissions from baseline levels by 2006 and 2012, respectively). However, because these standards will not take effect until 2006, subsequent to implementation of the snowmobile ban under either the current or delay-rule regulations, they will not change the potential impacts described below.

### **Potential Impacts of Proposed Regulation on Air Quality and Public Health in GYA Parks**

**Winter Use Season 2002–2003.** The baseline rule would limit the number of snowmobiles permitted to enter the parks. An analysis of the impacts on air quality due to limiting the number of snowmobiles entering the parks has not been conducted. However, limits on the number of snowmobile users in the parks should result in less congestion at the entrances and therefore reduce snowmobile emissions.<sup>6</sup> Restrictions on snowmobile use in the GYA national parks are, in general, expected to reduce harmful exposures to park visitors and workers, particularly for individuals (i.e., NPS staff) who spend extended periods in high-use areas.

The proposed delay rule allows unrestricted numbers of snowmobiles to enter the parks; therefore, benefits associated with improvements in air quality under the baseline rule would not be realized.

**Winter Use Season 2003–2004.** The ban of snowmobiles under the baseline rule would have eliminated impairment of air quality and human health from snowmobile emissions. If park visitors use snowcoaches instead of snowmobiles, that would result in fewer vehicles in the parks and reduce congestion at the park entrances. Moreover, snowcoaches would be required to meet the best available environmental standards for oversnow mass transit travel (NPS, 2002). Based on dispersion modeling, NPS concluded that

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<sup>6</sup>Although Alternatives 2 and 3 in the SEIS both limit the number of snowmobiles at the various entrances, they also include snowmobile emission standards and are not, therefore, appropriate for application to the baseline rule.

banning snowmobiles would lead to major beneficial effects in air quality in the parks. For example, the predicted maximum 1-hour CO concentration at the west entrance was 4.5 ppm, 86% lower than the current conditions; the predicted maximum 24-hour PM<sub>10</sub> concentration at the west entrance was 23.4 µg/m<sup>3</sup>, 66% lower than the current conditions (NPS, 2002).<sup>7</sup>

The proposed delay rule allows limited numbers of snowmobiles to enter the parks, and although this presumably would reduce the potential for impacts to air quality and human health relative to current conditions, it would not eliminate them as would have been done under the baseline rule. Therefore, benefits associated with improvements in air quality under the baseline rule would not be realized.

### **2.7.2 Visibility**

Although visibility effects can be characterized and measured in several different ways, “regional haze,” which uniformly reduces visual range and therefore impairs the appreciation of natural vistas, has been a particular source of concern. The primary contributor to regional haze and visibility impairments in general is associated with PM in the atmosphere that scatter and absorb light. There are several different sources and types of particles in the environment; however, sulfates (and to a lesser extent nitrates), primarily from the combustion of fuels, are the largest contributors to visibility reduction, especially in the eastern portions of the United States (Malm, 1999). Nationwide, the largest sources of sulfur dioxide emissions that contribute to sulfates in the atmosphere are power plants and other industrial sources. Mobile sources, such as cars, trucks, and buses (and snowmobiles), account for the largest portion of NO<sub>x</sub> emissions, which contribute to nitrates.

Table 2-13 compares typical emissions rates for snowmobiles and other vehicles for NO<sub>x</sub> and PM. These are the pollutants that are the most likely contributors to visibility impairments from snowmobile emissions. These emissions rates vary greatly across types and uses of these vehicles; however, the table shows that PM emissions for snowmobiles are particularly high relative to

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<sup>7</sup>Snowcoach emission factors based on model year 2000 light duty gasoline trucks.

**Table 2-13. Comparative Emissions Factors for Snowmobiles and Other Vehicles: NO<sub>x</sub> and PM**

	NO <sub>x</sub>	PM
Snowmobiles (lbs per 4 hr visit)	0.06	0.2
Automobiles (lbs per 4 hr drive <sup>a</sup> )	0.09–0.41	0.02
Diesel buses (lbs per 4 hr drive <sup>a</sup> )	3.22	0.26

<sup>a</sup>Assuming an average speed of 25 mph.

Source: National Park Service (NPS). February 2000a. *Air Quality Concerns Related to Snowmobile Usage in National Parks*. Denver, CO.

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*Snowmobiles can be a source of visibility impairment in national parks, but their contribution to overall levels of regional haze in these areas is likely to be quite small. Nevertheless, in high-use areas and periods, they may negatively affect visual air quality in a noticeable way.*

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automobiles. It should also be noted, however, that automobiles account for a very small portion of PM emissions nationwide.

The estimates in Table 2-13 suggest that snowmobiles can be a source of visibility impairment in national parks, but their relative contribution to overall levels of regional haze in these areas is likely to be quite small. Nevertheless, in high-use areas and periods, they may negatively affect visual air quality in a noticeable way.

### **Current Visibility Conditions in GYA Parks**

Vehicular emissions cause localized and perceptible visibility impairment near the west entrance, Old Faithful, and Flagg Ranch. Additionally, emissions along heavily used roadways result in localized visibility impairment (NPS, 2000c). Moreover, based on results from atmospheric modeling NPS (2000c), under current conditions snowmobiles are estimated to be responsible for more than 99% of the particulate matter at the west entrance and at the Old Faithful and Flagg Ranch staging areas.

### **Potential Impacts of Proposed Regulation on Visibility in GYA Parks**

**Winter Use Season 2002–2003.** An analysis of the impacts on visibility from limiting the number of snowmobiles entering the parks has not been conducted. However, limits on the number of snowmobile users in the parks should result in less congestion at the entrances and major corridors and thus should reduce snowmobile emissions and visibility impairments.<sup>8</sup>

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<sup>8</sup>Although Alternatives 2 and 3 in the SEIS both limit the number of snowmobiles at the various entrances, they also include snowmobile emission standards and are not, therefore, appropriate for application to the baseline rule.



The proposed delay rule would allow unrestricted numbers of snowmobiles to enter the parks; therefore, benefits associated with improvements in visibility under the baseline rule would not be realized.

**Winter Use Season 2003–2004.** The ban of snowmobiles under the baseline rule would have eliminated impairment of visibility from snowmobile emissions. In addition, NPS determined that vehicle emissions from snowcoaches would not cause any perceptible visibility impairment in the vicinity of the west entrance, Old Faithful, and Flagg Ranch or along the roadways (NPS, 2000c); thus, overall visibility would be improved.

The proposed delay rule would allow limited numbers of snowmobiles to enter the parks, and although this would reduce the potential for impacts to visibility relative to current conditions, it would not eliminate them. Therefore, benefits associated with improvements in visibility under the baseline rule would not be realized.

### **2.7.3 Water Resources**

The same constituents discussed under air quality are of concern when considering water quality and potential impacts to aquatic organisms. Although snowmobile-associated pollutants are directly released to air and the snowpack, they also have the potential to migrate to and contaminate water resources, primarily via deposition in the snowpack and subsequent melting into runoff that enters surface waters or shallow groundwater reservoirs in a concentrated pulse during spring snowmelt. Pollutants present in surface waters are available for uptake by aquatic resources such as vegetation, fish, amphibians, or others who are exposed to the contaminants in water. In addition, sunlight can further increase the toxic effect of PAHs to aquatic organisms (Mekenyan et al., 1994; Arfsten et al., 1996). Research evaluating the possible phototoxic effects of some PAHs to aquatic organisms (NCER, 1999) has demonstrated that toxicity may vary due to a number of factors including length of exposure; turbidity, humic acid, and organic carbon levels; the location of the organism relative to the surface of the water or the sediment; and weather/PAH fate issues (NCER, 1999). For instance, increased turbidity or organic carbon tended to reduce toxicity, increasing the length of exposure tended

to increase toxicity, and proximity to the surface (i.e., shallow waters) might increase toxicity.

### **Current Water Resource Conditions in GYA Parks**

The GYA encompasses a 3,500 square mile watershed. Surface water covers about 10 percent of GTNP and about 5 percent of YNP. Surface waters in both parks are designated Class 1 by the State of Wyoming, and their water quality is considered to be excellent. The parks are home to a vast array of native animals that depend on aquatic resources for all or part of their lives—more than 400 types of aquatic insects, 12 types of fishes, 10 types of reptiles and amphibians, at least 300 types of birds, 100 types of butterflies, and 60 types of mammals in YNP alone (NPS, 2000c).

Pollutants are deposited into the snowpack from two-cycle engine emissions along groomed park roads in YNP, GTNP, and the Parkway. Pollutants that persist in snowpacks or in soil can be washed into drainages with snowmelt or move through soil into nearby surface water sources or into groundwater storage over time. Contaminants from snowmobile discharges may migrate through snowmelt into surface waters, such as Jackson Lake whose frozen surface is currently used for snowmobiling and several other smaller lakes, ponds, and streams that are located near snowmobile routes. There is a potential risk of adverse effects on water quality, wetlands, and aquatic resources where oversnow motorized use closely parallels rivers and other bodies of water.

A snowpack pollutant study conducted in YNP and other areas in the Rocky Mountain region found that in YNP concentrations of ammonium, sulfate, benzene, and toluene were positively correlated with oversnow traffic (USDOI/USGS, 1998). Where increased snowmobile traffic occurred near West Yellowstone and Old Faithful, higher concentrations of the pollutants were detected. At the lower traffic locations near Lewis Lake Divide and Sylvan Lake, lower concentrations were found. At the higher snowmobile-use locations, in-road samples were substantially more concentrated than off-road samples. Concentrations of ammonium and sulfate at the sites in the snowpacked roadways between West Yellowstone and Old Faithful were greater than those observed at any of the 50 to 60 other snowpack-sampling sites in the Rocky Mountain region. Despite this correlation, there is currently no

evidence of measurable changes in water quality or effects on aquatic resources within the three parks. The study also indicates that there is a potential for localized acidification of aquatic ecosystems in high-snowmobile traffic areas, but that further site-specific studies would be necessary to verify this. Studies conducted to date have not documented exceedances of ambient water quality criteria.

Although adverse impacts to water resources have not been documented, NPS has identified five road segments totaling about 22 percent of the groomed trail system as “high risk” because 76 percent of each road segment is within 100 meters of rivers, lakes, or other waters (NPS, 2000c).

### **Potential Impacts of Proposed Regulation on Water Resources in GYA Parks**

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*Because there is no evidence that current levels of snowmobile use adversely affect water quality or aquatic resources in the parks, the proposed baseline rule is not likely to affect water resources in the park.*

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**Winter Use Season 2002–2003.** Because there is no evidence that current levels of snowmobile use adversely affect water quality or aquatic resources in the parks, the proposed baseline rule is not likely to affect water resources in the park. It should be noted that because the baseline rule would have eliminated all snowmobile use on Jackson Lake and would have reduced the number of snowmobiles in the parks in the 2002–2003 winter use season, it would have reduced the potential for water resources to be affected by snowmobile emissions.

The proposed delay rule would allow unrestricted numbers of snowmobiles to enter the parks and would eliminate the baseline rule’s reduction in potential impacts. However, because current use levels are not associated with adverse impacts on water quality, the impact of the delay rule on water quality is likely minimal.

**Winter Use Season 2003–2004.** A ban on snowmobile use is not expected to notably improve water quality in GYA parks because current use levels are not associated with adverse impacts on water quality. Nonetheless, the ban of snowmobiles under the baseline rule would have eliminated the potential for water resources to be affected by snowmobile emissions. Emissions from snowcoaches may also affect water resources; however, a single snowcoach produces fewer emissions than a single snowmobile (NPS, 2000c). Therefore, the overall reduction in the motorized vehicles operating

in the parks (and the associated reduction in total oversnow vehicle miles traveled) would have reduced the potential for water resources to be affected by emissions.

The proposed delay rule would allow limited numbers of snowmobiles to enter the parks, and although this would reduce the potential for impacts from snowmobiles to water resources relative to current conditions, it would not eliminate them. Therefore, benefits associated with improvements in water quality under the baseline rule would not be realized

#### 2.7.4 Soundscape

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*NPS attempts to prevent or minimize unnatural sounds that adversely affect the natural soundscape.*

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Perhaps the most noticeable and intrusive aspect of snowmobiles is the level of noise they emit during normal operation. The natural soundscape is considered a natural resource of the park, and NPS attempts to prevent or minimize unnatural sounds that adversely affect the natural soundscape. National parks are especially valued for their pristine and undisturbed environments, which are often experienced by visitors through natural vistas and through the relative absence of visible or audible human activity (NPS, 2000b).

As shown in Table 2-14, estimates of noise levels from snowmobiles vary widely. The Snowmobile Safety and Certification Committee states that certified snowmobiles emit roughly 73 decibels (dB) of sound when traveling at 15 mph and no more than 78 dB traveling at full throttle at 50 feet away.<sup>9</sup> Other information sources list the noise emissions from snowmobiles at as much as 100 dB (League for the Hard of Hearing, 2000; OMGSIC, 2000). Moreover, the amount of noise from snowmobiles can vary

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<sup>9</sup>The *Code of Federal Regulations*, Title 36, Chapter 1, Part 2.18 states that operating a snowmobile that makes excessive noise in any national park, monument, lakeshore, or recreation area is prohibited. The rule defines excessive noise as a decibel level (dB, measured on an A-weighted scale measured at 50 feet) depending on the period that the snowmobile was manufactured: 78 dB for snowmobiles manufactured after July 1, 1975, 82 dB for snowmobiles manufactured between July 1, 1973, and July 1, 1975, and 86 dB for snowmobiles manufactured before July 1, 1973 (from 36 CFR 7-1-90 edition). Snowmobiles manufactured since February 1, 1975, and certified by the Snowmobile Safety and Certification Committee may emit no more than 78 dB from a distance of 50 feet while operating at full throttle (when tested under the Society of Automotive Engineers J192 procedures). In addition, those manufactured after June 30, 1976, and certified by the Snowmobile Safety and Certification Committee may emit no more than 73 dB at 50 feet while traveling at 15 mph. However, the after-market modification of snowmobile exhaust systems or substitution of factory-installed with after-market racing exhaust systems can increase the potential noise impacts of snowmobiles.

considerably across models and different types of use.<sup>10</sup> To put these noise-level estimates into perspective, Table 2-14 also compares them with those of other familiar sounds.

**Table 2-14. Comparative Noise Emissions**

Source	Decibel Level
Firearms	140
Motorcycle	90–110
Snowmobiles	73–100
Vacuum cleaner	70
Normal conversation	60
Normal breathing	10

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*Noise emissions from snowmobiles can present a significant disturbance, particularly in areas that are valued for their natural quiet. This problem can also be particularly acute in high-use areas, such as in YNP.*

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### **Current Soundscape Conditions in GYA Parks**

Clearly, noise emissions from snowmobiles can present a significant disturbance, particularly in areas that are valued for their natural quiet. This problem can also be particularly acute in high-use areas, such as in YNP. For example, a recent study of YNP found that 11 out of 13 sites surveyed had audible snowmobile noise more than 70 percent of the time, and that natural sounds were often rendered inaudible (NPCA, 2000).

Areas of primary concern are those in which mechanized noise from wheeled (e.g., cars in GTNP) or oversnow vehicles on plowed, groomed, or ungroomed motorized trails and routes affect the natural soundscape within the parks. In areas adjacent to park entrances, park lodging (e.g., Flagg Ranch and the Snow Lodge), and motorized trails, routes and plowed roads, human-generated activity is high, human encounters with wheeled or oversnow vehicles are the norm, and the natural soundscape is often obscured by sound from these snowmachines. However, even in these areas at times when human-generated sound is not present, the natural sound environment may be very quiet. These areas

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<sup>10</sup>Other factors that influence the pitch and intensity of snowmobile engine noise include alterations of engine and the exhaust systems and travel speed (ISMA, 2000). Sound waves travel faster in low atmospheric pressure and colder temperatures, and geographical features and other environmental objects absorb them. As a result, snowbanks and trees can cause a 10 to 20 dB noise level reduction if they are located between the snowmobile and receiver (ISMA, 2000).

include snowmobile routes or campgrounds where snowmobile access is allowed, such as park entrances and Flagg Ranch.

For areas somewhat removed from the motorized trails, routes, and plowed roads, human-generated sound is generally present at lower levels and for less time. With reduced human-generated sound compared to the areas adjacent to the motorized trails, routes, and plowed roads, the natural soundscape is not as affected and visitors have increased opportunities to experience natural soundscapes.

In distant areas substantially removed from the influence of plowed roads or motorized oversnow trails and routes, human-generated sound is rare. Natural soundscapes remain unimpaired most or all the time in such distant backcountry areas. Sounds from wheeled or oversnow vehicles are only occasionally audible within the background sound in such areas, depending on the proximity of the motorized trails and routes, local topography, and sound emission levels of these vehicles.

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*Noise emissions have been identified as a particular nuisance to nonmotorized park users, such as cross-country skiers and snowshoers, who tend to place a particularly high value on the tranquility and natural soundscape offered by the parks. Snowcoach users are also frequently disturbed by snowmobile noise, especially during stops to view wildlife and enjoy the landscape.*

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Noise emissions have been identified as a particular nuisance to nonmotorized park users, such as cross-country skiers and snowshoers, who tend to place a particularly high value on the tranquility and natural soundscape offered by the parks. Even though the park has several backcountry areas where these visitors can recreate without being disturbed by snowmobiles, under current conditions, it is virtually impossible for them to do so in the vicinity of the parks' main attractions. Park officials indicate that snowcoach users are also frequently disturbed by snowmobile noise, especially during stops to view wildlife and enjoy the landscape. In contrast to skiing or snowshoeing, it is nearly impossible for snowcoach users to avoid contact with snowmobilers because they use the same routes.

Researchers measured sound levels at four locations in YNP and four sites in GTNP in February and March 2000 (Bowlby & Associates, Inc., 2000; Harris Miller Miller & Hanson, Inc., 2000). The sites were chosen to provide a mix of areas with both heavy and light oversnow vehicle use. Although this was a limited study both in duration and in spatial coverage, the measurements that were made indicated that the percentage of time snowmachines were audible during daytime at various locations was the following:

➤ Old Faithful	95 percent
➤ Grand Canyon of the Yellowstone	87 percent
➤ West Thumb	57 percent
➤ Pelican Valley	44 percent
➤ Flagg Ranch	63 percent
➤ Colter Bay	46 percent
➤ Pacific Creek Road	6 percent
➤ Taggart Lake Trailhead	2 percent

The audibility results for the monitored sites cannot be extrapolated to cover more remote parts of the parks.

Currently nonnatural sounds affect the soundscape in the three park units. Vehicles (wheeled and/or oversnow) are estimated to be audible over more than 200,000 acres of parkland, and audible more than 50 percent of the time over more than 26,000 acres.<sup>11</sup> Average noise levels are estimated to be highest from the west entrance to Old Faithful (56 dB) and on Jackson Lake (58 dB). It was determined that average noise levels exceeding 50 dB at 100 feet could be found at any point along nine road segments, or on 144 miles of groomed road (NPS, 2002).

### ***Potential Impacts of Proposed Regulation on the Soundscape in GYA Parks***

**Winter Use Season 2002–2003.** The baseline rule limits the number of snowmobiles allowed access from each entrance. Noise analyses for this rule were conducted for only the final implementation of the rule, which involved using snowcoaches only (see impacts for the winter use season 2003–2004). It is assumed, however, that reducing the number of snowmobiles in the park would reduce noise levels associated with snowmobiles.

The proposed delay rule would allow unlimited snowmobile use in the parks; therefore, benefits associated with improvements in the soundscape under the baseline rule would not be realized.

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<sup>11</sup>An acoustical model was developed to compute the effects of existing (February & March 2000) and potential oversnow and road vehicle noise emissions on the natural soundscape in YNP and GTNP (Harris Miller Miller & Hanson, Inc., 2000).

**Winter Use Season 2003–2004.** Under the baseline rule, snowmobiles would have been banned from the parks in winter 2003–2004, although snowcoaches would have continued to operate on the current snowmobile routes. Snowcoaches also generate noise but usually at a lower level and pitch than most snowmobiles.<sup>12</sup> More importantly, fewer snowcoaches are needed on a per-visitor basis compared to snowmobiles. NPS estimated that, even if total visitation at the parks were to remain constant, the number of affected acres with audible noise 10 percent of the time or more would drop by 11 percent, and the acreage over which vehicles are audible 50 percent or more of the time would drop by 47 percent. The average noise level would not exceed 50 dB at 100 feet on any road segment (NPS, 2002).<sup>13</sup>

The proposed delay rule would allow limited numbers of snowmobiles to enter the parks, and although this presumably would reduce the noise impacts from snowmobiles relative to current conditions, it would not be expected to reduce noise nearly as much as a ban would. Therefore, benefits associated with improvements in the soundscape under the baseline rule would not be realized.

### **2.7.5 Geothermal**

Adverse impacts can occur to geothermal features when visitors have unregulated access to geothermal basins. Park visitors can alter or damage geothermal resources by traveling off trail or throwing objects into these features. Harm to geothermal resources also affects plants and animals that depend on them.

#### **Current Geothermal Features Conditions in GYA Parks**

In areas of unregulated access, geothermal features near groomed roads, around destination areas, and near winter trails in the backcountry suffer minor adverse long-term impacts. Park visitors

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<sup>12</sup>According to the NPS (NPS, 2002), snowmobiles emit roughly 73 dBA at 50 feet (at an average speed of 40 mph); whereas conversion van coaches emit 70 dBA at 30 mph. Bombardier coaches, which are less common, emit 75 dBA at 30 mph.

<sup>13</sup>Audibility estimates for SEIS Alternatives 1a and 1b (and for FEIS Alternative G) are for final implementation, assuming no motor vehicles on Jackson Lake and Teton Park Road, and the replacement of snowmobiles and wheeled vehicles with snowcoaches from Colter Bay to Flagg Ranch and on Grassy Lake Road.



can alter or damage geothermal resources by traveling off trail or throwing objects into these features.

### ***Potential Impacts of Proposed Regulation on Geothermal Features in GYA Parks***

**Winter Use Season 2002–2003.** Although it has not been explicitly studied, limiting the number of snowmobiles entering the parks may reduce impacts to geothermal features relative to current conditions if more visitors access the features with a guide or on a snow coach and those visitors are educated on how to make their visit as low impact as possible.

The proposed delay rule would allow unlimited snowmobile use in the parks; therefore, any potential benefits to geothermal features associated with limiting snowmobiles under the baseline rule would not be realized.

**Winter Use Season 2003–2004.** The ban of snowmobiles under the baseline rule would eliminate impacts to geothermal features by snowmobile riders. NPS anticipates that park management would maintain increased control over visitors accessing geothermal features using snowcoaches compared to snowmobile users, thus increasing protection for geothermal features in areas where there are adverse impacts. The increased opportunity to inform visitors of adverse impacts on geothermal resources would also provide minor beneficial improvements to the protection of geothermal features (NPS, 2000c).

Under the proposed delay rule, fewer snowmobiles would be permitted to enter the parks, potentially reducing somewhat the number of visitors with unregulated access to geothermal features. However, compared to the ban associated with the baseline rule, impacts will likely be greater on geothermal features.

## **2.7.6 Wildlife**

The parks protect the largest number and greatest variety of animal species in the lower 48 states. They protect two federally listed endangered species—the gray wolf and the whooping crane—and three threatened species—the grizzly bear, the bald eagle, and the lynx. The parks are home to the largest concentration of elk in the

world. They are the only place in the U.S. where bison have existed in the wild since primitive times.

As described above, snowmobile use leads to increased noise and air pollutant emissions. Noise may disrupt wildlife use patterns, and terrestrial habitat may be disturbed, particularly when snowmobiles trespass off of the designated trails into areas with sensitive habitat. In addition, emissions deposited in the snowpack may migrate into the park's water resources and, if in high enough concentrations, they may adversely affect aquatic ecosystems. Each of these effects is described in more detail below.

- **Noise.** Wildlife can be affected by the noise and physical presence of snowmobiles. Numerous studies have evaluated the extent to which noise and the physical presence of snowmobiles can cause physiological stresses and changes in wildlife activity patterns and feeding habits (Boyle and Samson, 1985; Eckstein et al., 1979; Freddy, Bronaugh, and Fowler, 1986; Richens and Lavigne, 1978; Moen, Whittemore, and Buxton, 1982). The evidence from these studies is mixed, but some negative effects on wildlife may exist. Additional impacts may include changes in distribution and movement, habitat use, and energetics. It should be noted that many of these wildlife studies document that the presence of humans on foot or on cross-country skis significantly also disturb wildlife (Eckstein et al., 1979; Freddy, Bronaugh, and Fowler, 1986).
- **Snow Compaction.** Compaction of the snowpack may pose several potential impacts to wildlife. Wildlife can take advantage of the snowpacked trail to increase their mobility, and ultimately this can change winter home ranges and predator prey relationships (Aune, 1981; Dorrance, Savage, and Huff, 1975; Nelson and Mech, 1984; Neumann and Merriam, 1972; Paquet, Wierczowski, and Callaghan, 1996; Richens and Lavigne, 1978). Schmid (1971) demonstrated that compaction can alter the mild subsnow microclimate, and Pruitt (1971) found that energy expenditure of burrowing small mammals increases in denser snow. Burrowing small mammals, therefore, may be adversely affected by snowpack compaction.
- **Habitat Disturbance.** Because designated snowmobile trails in the national park system are restricted to roads used for automobile/RV/bus travel in the nonsnow season, there should be no increase in terrestrial habitat disturbance on snowmobile trails because the habitat has already been altered and is used by other vehicles. However, trespass in nondesignated snowmobile trails may occur, resulting in damage to vegetation and/or habitat. If the snowpack is deep, trespassing in offroad habitats may not result in any damage to plants and habitat covered adequately by the

snow. However, if saplings or other vegetation extend above the snow surface, there may be significant vegetative damage (Neumann and Merriam, 1972), and if trespassing occurs when there is little snow on the ground, surface soil and vegetation on the bare ground may be affected.<sup>14</sup>

- **Water Quality.** As described in Section 2.7.3, pollutants in snowmobile emissions can potentially affect water quality via deposition in the snowpack and subsequent melting into runoff. Although elevated emission concentrations along the snowmobile corridors have been detected, it is generally dispersed into the surrounding watersheds at concentrations below levels likely to threaten human or ecosystem health (USDOI/USGS, 1998).

Other winter uses and means of access also produce impacts. Cross-country skiing and other nonmotorized forms of recreation have been shown to affect wildlife. Winter recreation activities (motorized and nonmotorized) take place during the season when animals are stressed by climate and food shortages. Snow depth, cold temperatures, and lack of high quality forage can lead to synergistic and nutritional stress, and consequently higher rates of competition and mortality. Disturbance or harassment of wildlife during this sensitive time can have a negative effect on individual animals and, in some cases, populations as a whole. The most critical times for wildlife involve cold weather, late pregnancy, and other times when animals are in a state of negative energy balance. The consequences of human-caused wildlife disturbance may include elevation of heart rate and metabolism, flight, displacement from habitats, reduced reproduction, increased susceptibility to predation, and diminished health as a result of increased energy costs. Thus, although animals may appear unaffected by human activities, adverse effects may be occurring nonetheless.

### ***Current General Wildlife Conditions in GYA Parks***

In YNP's Madison, Firehole, and Gibbon River valleys, Aune (1981) reported that wildlife developed crepuscular patterns in response to winter recreation activity, were displaced from trailsides, and experienced inhibited movements because of traffic and snow berms created by plowing and grooming operations. A review of 232 publications on the impacts of recreation on wildlife

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<sup>14</sup>It should be noted that the damages associated with this type of trespassing may not be reduced (and may actually increase) as a result of snowmobiling restrictions. This must be accounted for in assessing the net benefits of proposed restrictions.

concluded that in general living near small numbers of nonaggressive humans did not significantly affect wild animals. However, recreationists, because of their numbers and sometimes inappropriate behavior, were causing severe impacts resulting from harassment and the habituation of particular species (NPS, 2000c).

### ***Ungulates***

**Current Ungulate Conditions in GYA Parks.** Ungulate species, such as elk and bison, are of primary concern, because of their numbers and frequent proximity to snowmobile routes. This proximity can lead to harassment of wildlife along the groomed roads, due to the numbers and occasional inappropriate behavior of snowmobilers. In some instances, the physical safety of the animals is threatened by the presence of motorized oversnow vehicles. For example, between 1988 and 1998, 14 ungulates were killed by snowmobiles in YNP (NPS, 2000c). In general, however, the adverse effects of collisions with snowmobiles are negligible and short term.

Although wildlife-visitor conflicts are frequently not recorded in CIRs, park rangers have noted the frequent, often daily occurrence of conflicts among ungulates (primarily bison) and oversnow vehicles (primarily snowmobiles) (NPS, 2002). The most commonly cited problem involved snowmobilers unsafely passing bison. Although this harassment is usually unintended, the juxtaposition of heavily used groomed motorized routes and ungulate winter range renders it virtually inevitable along some road segments.

It is unknown to what extent any beneficial effects outweigh negative effects of groomed surfaces and plowed roads on ungulate movements. Packed trails may influence wildlife movements and distributions by facilitating travel into areas that would normally be inaccessible because of deep snow. Minor to moderate adverse effects are related to displacement and fragmentation of habitat for elk in the short term (NPS, 2002).

### ***Potential Impacts of Proposed Regulation on Ungulates in GYA Parks***

**Winter Use Season 2002–2003.** Although analyses of the impacts on wildlife from limiting the numbers of snowmobiles entering the parks have not been conducted, reductions in the number of

snowmobiles in the parks would likely reduce the frequency of snowmobile–ungulate conflicts. It would also reduce wildlife exposure to snowmobile noise and contaminant emissions. Wildlife access to groomed surfaces would remain, and as described under current conditions, the net impact of groomed trails on ungulates is unknown.

The proposed delay rule would allow unrestricted numbers of snowmobiles to enter the parks and would eliminate benefits associated with the baseline rule’s potential to reduce snowmobile emission-related impacts and wildlife conflicts.

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*NPS anticipates that using mass transit would greatly reduce the total number of vehicles and vehicle miles traveled, thereby reducing the opportunities for wildlife to be disturbed. Snowcoaches, driven by trained drivers, would also lead to the ability to control when and where stops are made, thereby reducing potential visitor–wildlife conflicts.*

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**Winter Use Season 2003–2004.** The ban of snowmobiles under the baseline rule would eliminate all potential impacts to wildlife from snowmobile noise and contaminant emissions and would also eliminate all potential conflicts from interactions with snowmobiles. Although the total miles of groomed surfaces would be reduced (GTNP and the Parkway), ungulates would still have access to groomed snowcoach routes throughout the parks, and the potential for snowcoach–ungulate conflicts would also remain. The net effects of groomed surfaces, as described under current conditions, are unknown. NPS anticipates that using mass transit would greatly reduce the total number of vehicles and vehicle miles traveled, thereby reducing the opportunities for wildlife to be disturbed (NPS, 2002). Snowcoaches, driven by trained drivers, would also lead to the ability to control when and where stops are made, thereby reducing potential visitor–wildlife conflicts.

The proposed delay rule would allow limited numbers of snowmobiles to enter the parks, and although this would reduce the potential for impacts to wildlife from snowmobile noise and contaminant emissions and reduce potential conflicts from interactions with snowmobiles relative to current conditions, it would not eliminate them. Therefore, benefits associated with the ban of snowmobiles under the baseline rule would not be realized.

### **Federally Protected Species**

Four species protected under the Endangered Species Act (ESA) are present in the parks in the winter. Threatened species include the Canada lynx (*Lynx canadensis*), bald eagle (*Haliaeetus leucocephalus*), and grizzly bear (*Ursus arctos horribilis*). The gray

wolf (*Canis lupus*), although also listed as threatened, is considered experimental and nonessential within YNP.

Motorized routes pass through potential lynx habitat in the parks. Assessing the degree of impacts to lynx in the parks is speculative because very little is known about lynx distribution and abundance. Motorized oversnow recreation may affect lynx by fragmenting habitat, reducing the effectiveness of intact habitat, causing displacement from or avoidance of habitat, and creating added energetic stress. Lynx may be affected by groomed routes because snow compaction may enable other predators, especially coyotes, to compete in deep snow conditions where lynx would otherwise have an advantage. Increased competition may reduce the value of habitat for lynx and exclude them altogether.

The primary effect of oversnow, motorized use on bald eagles is displacement of foraging eagles, especially along river corridors (e.g., the Madison River from the west entrance to Madison Junction; the Firehole River to Old Faithful; the Gibbon River near Norris; and the Yellowstone River from Fishing Bridge to Canyon).

Any potential effects of recreation on denning bears are mitigated because, in the parks, preferred denning habitats are generally remote, and snowmobiles are required to stay on designated routes. The likelihood of visitors encountering grizzly bears in the initial weeks of the winter use season (mid- to late December) is extremely small because the vast majority of bears (about 96 percent) have denned by the second week of December. Winter activities in late February and March may conflict with emerged male grizzly bears, 31 percent of which are out of their dens by March 15. In particular, activities in ungulate winter range may disturb grizzly bears feeding on winter-killed carcasses. In YNP, ungulate winter range includes geothermally influenced areas in the Firehole, Gibbon, and Norris vicinities where the potential for human–bear conflict in the spring is high.

Gray wolves may be affected by disturbance from motorized oversnow vehicles. Wolves have been documented to avoid areas of snowmobile activity, thus becoming permanently displaced from some habitats. Although wolves have not been documented to travel on groomed snowmobile routes in YNP, they do use areas

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*In general, the primary potential impact of concern for federally protected species relates to avoidance of habitat associated with oversnow vehicles and other backcountry visitors; however, this impact is expected, for the most part, to be negligible.*

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near groomed snowmobile roads in ungulate winter range, and in 1997, a pack was displaced from an elk carcass by snowmobiles.

In general, the primary potential impact of concern for federally protected species relates to avoidance of habitat associated with oversnow vehicles and other backcountry visitors; however, this impact is expected, for the most part, to be negligible (NPS, 2000c).

### **Potential Impacts of Proposed Regulation on Federally Protected Species in GYA Parks**

**Winter Use Season 2002–2003.** As described above, current impacts to federally threatened species generally are believed to be negligible. Potential changes in impacts from limiting the number of snowmobiles under the baseline rule in the 2002–2003 winter use season are expected to be similar to those stated for ungulates.

The proposed delay rule would allow unrestricted numbers of snowmobiles to enter the parks and would eliminate benefits associated with the baseline rule's potential to reduce snowmobile emission-related impacts and wildlife conflicts specifically as they relate to federally threatened species.

**Winter Use Season 2003–2004.** As described above, current impacts to federally threatened species generally are believed to be negligible. Potential changes in impacts from banning snowmobiles under the baseline rule in winter 2003–2004 are expected to be similar to those stated for ungulates.

The proposed delay rule would allow limited numbers of snowmobiles to enter the parks. Although this would likely reduce the potential for impacts to federally threatened species from snowmobile noise and emissions and reduce potential conflicts from interactions with snowmobiles relative to current conditions, it would not eliminate them. Therefore, benefits associated with the ban of snowmobiles under the baseline rule would not be realized.

### **Species of Concern**

Species of special concern are those species for which data are sufficient to document that the species is in decline, or species that because of their unique or highly localized habitat requirements warrant special management. Most species of special concern in the parks are not winter residents and are therefore unaffected by

winter use. Species of special concern that occur in the GYA national parks year round include the wolverine (*Gulo gulo*), fisher (*Martes pennanti*), American Marten (*Martes americana*), river otter (*Lutra Canadensis*), trumpeter swan (*Cynus buccinator*), northern sagebush lizard (*Sceloporus graciosus graciosus*), rubber boa (*Charina bottae*), and boreal toad (*Bufo boreas boreas*) as well as several fish. The most likely impacts on species of special concern in the parks are displacement from preferred habitats and degradation of the aquatic environment from pollutants in the snowpack, although effects in the aquatic environment have not been documented. Similarly, river otters, fish, and amphibians may be directly affected by degradation of the aquatic environment, but these effects have not been demonstrated. Trumpeter swans that winter near snowmobile routes may experience minor impacts when they are in the vicinity of snowmobile traffic. For example, trumpeter swans that winter along the Lewis, Firehole, Madison, and Yellowstone Rivers may be affected by the presence of motorized oversnow traffic, but this disturbance is considered negligible to minor. Impacts from groomed surfaces are considered negligible.

### **Potential Impacts of Proposed Regulation on Species of Concern in GYA Parks**

**Winter Use Season 2002–2003.** As described above, current impacts to species of special concern generally are believed to be negligible. Potential changes in impacts from limiting the number of snowmobiles under the baseline rule in the 2002–2003 winter use season, particularly with respect to snowmobile noise and contaminant emissions, are expected to be similar to those stated for ungulates.

The proposed delay rule would allow unrestricted numbers of snowmobiles to enter the parks and would eliminate benefits associated with the baseline rule's potential to reduce snowmobile emission-related impacts and conflicts with species of special concern.

**Winter Use Season 2003–2004.** As described above, current impacts to species of special concern generally are believed to be negligible. Potential changes in impacts from banning snowmobiles under the baseline rule in winter 2003–2004,



particularly with respect to snowmobile noise and contaminant emissions, are expected to be similar to those stated for ungulates.

The proposed delay rule would allow limited numbers of snowmobiles to enter the parks. Although this would likely reduce the potential for impacts to species of special concern from snowmobile noise and emissions and reduce potential conflicts from interactions with snowmobiles relative to current conditions, it would not eliminate them. Therefore, benefits associated with the ban of snowmobiles under the baseline rule would not be realized.

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## **2.8 ECONOMIC ACTIVITY IN THE SURROUNDING COMMUNITIES**

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*Numerous communities rely heavily on income from tourists visiting YNP, GTNP, and the Parkway.*

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Numerous communities rely heavily on income from tourists visiting YNP, GTNP, and the Parkway. However, the area of analysis for the regional economy in the SEIS (NPS, 2002) is a five-county portion of the GYA that includes the counties in Montana, Wyoming, and Idaho surrounding the parks: Fremont in Idaho, Gallatin and Park in Montana, and Park and Teton in Wyoming. This area was chosen to include the parks and contiguous lands, as well as other nearby lands and communities most frequently visited by nonlocal people traveling to the area. These counties have an economic base dominated by tourism. In addition to communities located within the five-county area chosen for analysis, many communities outside this area are affected by visitor spending in the parks. However, the proportion of their economies dependent on visitation to the parks tends to be much lower than in the counties adjacent to the parks. Thus, the focus of the analysis is on the counties most affected by a reduction in visitation.<sup>15</sup>

Four main routes provide access to YNP in the winter:

- U.S. Highway 89 through Gardiner, Montana, which serves the north entrance, 54 miles south of Livingston, Montana
- U.S. Highway 16, which connects Cody, Wyoming, located 53 miles east of the park, to the east entrance

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<sup>15</sup>NPS evaluated the 17-county GYA in an earlier study but has since refined the area of analysis at the request of cooperating agencies. The primary drawback of analyzing the larger area is that it may understate the impacts on the most directly affected communities. The percentage reduction in economic activity is much smaller for the 17-county region than for the 5-county region that includes those counties most dependent on YNP, GTNP, and Parkway tourism.

- the Parkway (U.S. Highway 89/287), which provides access to Flagg Ranch, 2 miles prior to the south entrance
- U.S. Highways 20 and 287, which provide access to the west entrance through West Yellowstone

The major routes into GTNP are the following:

- U.S. Highways 89 from the south and 26/287 from the east, which provide local park access from Jackson and Moran, Wyoming; and
- U.S. Highway 26/28, which provides access from Dubois, Wyoming, about 50 miles east of Moran.

The interstate highway system provides regional access to the vicinity of the parks:

- Interstate 15 on the west side, connecting Idaho Falls, Idaho, and Butte, Montana, and
- Interstate 90 on the north and northeast sides, connecting Butte, Montana, with Bozeman, Livingston, and Billings, Montana, and Sheridan, Wyoming.

In addition, the Parkway provides access between YNP and GTNP. It is open year-round between the northern boundary of GTNP and Flagg Ranch.<sup>16</sup> Flagg Ranch is the major winter destination on the Parkway and serves as a staging area for oversnow access to YNP.

Small communities adjacent to the parks such as West Yellowstone, Gardiner, Cooke City, or Flagg Ranch are highly dependent on park visitor spending, while larger communities such as Bozeman derive a much smaller share of their economic activity from park visitor spending. This is because the larger communities tend to have a much more diverse economic base, which relies less heavily on park-based tourism (although it is still a vital part of their economies), and they are located farther away from the parks.

Public lands provide the basis for much of the economic activity (recreation, mining, forestry, and agriculture) that occurs in the five counties. The GYA's overall economy has been changing for more than 20 years. The economy has shifted from a dependence on commodity extraction to a more diversified economy based on recreation, tourism, and service industries. For example, between 1969 and 1989, more than 96 percent of all jobs in the larger

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<sup>16</sup>This route is closed in the winter to wheeled vehicles north of Flagg Ranch through YNP.

17-county GYA area came from sectors other than timber, mining, and agriculture (Rasker, Tirrel, and Kloeppfer, 1992).

Table 2-15 shows employment by economic sector in the five counties. Most jobs related to the recreation and tourism industry are found in the retail trade and services sectors of a county's economy. These sectors are much broader than recreation and tourism, however, and include activities such as health care. These two sectors account for about 42 percent of the earnings in the five-county area. Businesses related to recreation in the parks include lodging establishments, restaurants, grocery stores, souvenir shops, snowmobile rental firms, and recreational equipment rental firms (e.g., skiing equipment rentals).

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*Only 4 to 5 percent of annual recreational visitation to YNP occurs during the winter (defined as the period from December to March).*

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Recreational use of the environment is a large component of the area's economy. However, in the context of total annual recreation expenditures in the area, winter recreational expenditures are much less important than non-winter recreational expenditures. Only 4 to 5 percent of annual recreational visitation to YNP occurs during the winter (defined as the period from December to March).

Within YNP, snowmobile rentals and snowcoach tours are available at Old Faithful and Mammoth. About 45 machines are available in total at Mammoth Hot Springs and at Old Faithful for self-guided tours; the exact distribution of these machines varies on an as-needed basis. In West Yellowstone, approximately 30 companies rent snowmobiles for self-guided tours or offer guided snowmobile tours (with approximately 1,400 snowmobiles available for rent [NPS, 2000c]). In addition, at least seven companies have snowcoaches available, and two provide cross-country ski equipment and guided tours.<sup>17</sup> Seven operators located in West Yellowstone are licensed by YNP to provide guided snowmobile tours in the park. The guided snowmobile tours are limited to 11 snowmobiles each, including guides. In addition, seven companies are licensed to provide snowcoach tours within the park, and one company is licensed for cross-country ski tours in the park operating out of West Yellowstone.

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<sup>17</sup>The concession numbers are based on the 2001–2002 NPS Contract List. Several rental shops housed multiple businesses. In many cases only one of the businesses has a concession to operate in the park, but this allows the rental company to advertise guided tours.

**Table 2-15. Employment by Industry for Five-County GYA in 1996**

Industry Classification	Five-County GYA Area Employment	Percentage of Total Area Employment
<b>Farm</b>	3,417	3.62%
<b>Nonfarm</b>	90,947	96.38%
<b>Private</b>	75,814	80.34%
Construction	8,149	8.64%
Insurance and Real Estate	6,109	6.47%
Manufacturing	4,872	5.16%
Mining	1,043	1.11%
Miscellaneous, Agriculture, and Forestry	1,728	1.83%
Retail	19,371	20.53%
Services	28,683	30.40%
Transport and Utilities	3,235	3.43%
Wholesale	2,624	2.78%
<b>Government</b>	15,133	16.04%

Source: U.S. Department of Commerce, Bureau of Economic Analysis. 1998. Regional Economic Information System.

Outside of West Yellowstone to the north of the park in Bozeman, Big Sky, and Moran, six additional businesses are licensed to offer cross-country ski tours in the park, and four businesses were identified as providing snowcoach tours. Additionally, a single snowmobile rental shop located in Victor, Idaho, offers guided tours through the west entrance of YNP.

To the east of the park, two licensed snowmobile tour operators are located in Pahaska Teepee and Cody, Wyoming. One snowmobile rental shop was also identified in Cooke City, Montana, to the northeast of the park, but this shop is not licensed to provide guided tours in the park.

To the south of YNP, approximately 11 companies are licensed to offer guided snowmobile tours of YNP or GTNP (located in Jackson and Moran, Wyoming, and Teton, Idaho). An additional 12 companies were located that rent snowmobiles for self-guided tours in Jackson, Moran, and other nearby communities in Wyoming and Idaho. For GTNP and the Parkway, Flagg Ranch is the major staging area for oversnow travel from the south to YNP. The primary winter users at Flagg Ranch are commercial snowmobile

tour operators, private snowmobiles, snowcoach tour operators, Flagg Ranch snowmobile renters, and cross-country skiers. In 2001–2002, 11 commercial snowmobile tour permits were issued at Flagg Ranch. Three snowcoach operators offer tours through the South Gate of YNP, two located in Jackson and another in Moran. Snowcoach operators currently load and unload tourists in front of the lodge at Flagg Ranch. Six to ten snowcoaches, each accommodating 11 people, run daily into YNP. There is a concessionaire that maintains 85 snowmobiles for rental to lodgers and day users (NPS, 2000c). Finally, three cross-country ski companies located in Lander, Wyoming; Eugene, Oregon; and Sun Valley, Idaho, are licensed to provide guided cross-country ski tours in YNP.

Winter lodging facilities within YNP provide a total of 256 rooms with 413 beds between facilities at Mammoth Hot Springs and Old Faithful. In addition to the above lodging facilities, there are 10 yurts (a type of wilderness shelter), plus a community yurt, and a mess yurt. The yurt camp logged 418 user days during the winter of 1998–1999. For GTNP and the Parkway, Flagg Ranch and Triangle X are permitted by NPS to provide overnight accommodations during the winter. In addition to these accommodations within the parks, numerous lodging establishments are located outside of park boundaries (NPS, 2000c). Borrie et al. (1999) found that 84 percent of the respondents to their winter survey stayed the night near YNP, but 93 percent of those staying overnight spent the night in a hotel or motel outside the park. In this survey, West Yellowstone, Jackson, Bozeman, and Big Sky were the most frequently visited communities for overnight stays.

There are also a large number of restaurants, grocery stores, gas stations, souvenir shops, and other retail establishments in the five-county portion of the GYA that depend on visitation to the park for a large proportion of their income. Just as for the recreational equipment rental shops and lodging establishments, a large part of winter income for these establishments depends on snowmobiling.

# 3

## Benefit-Cost Analysis of the New Regulation

In this section NPS attempts to quantify the benefits and costs to affected groups associated with delaying implementation of the January 2001 rule on snowmobiling in the GYA.

The purpose of benefit-cost analysis is to evaluate the social welfare implications of a proposed action—in this case the regulation of snowmobile use in GYA national parks. It examines whether the reallocation of society's resources resulting from the action promotes efficiency. That is, it assesses whether the action imposes costs on society (losses in social welfare) that are less than the benefits (gains in social welfare).

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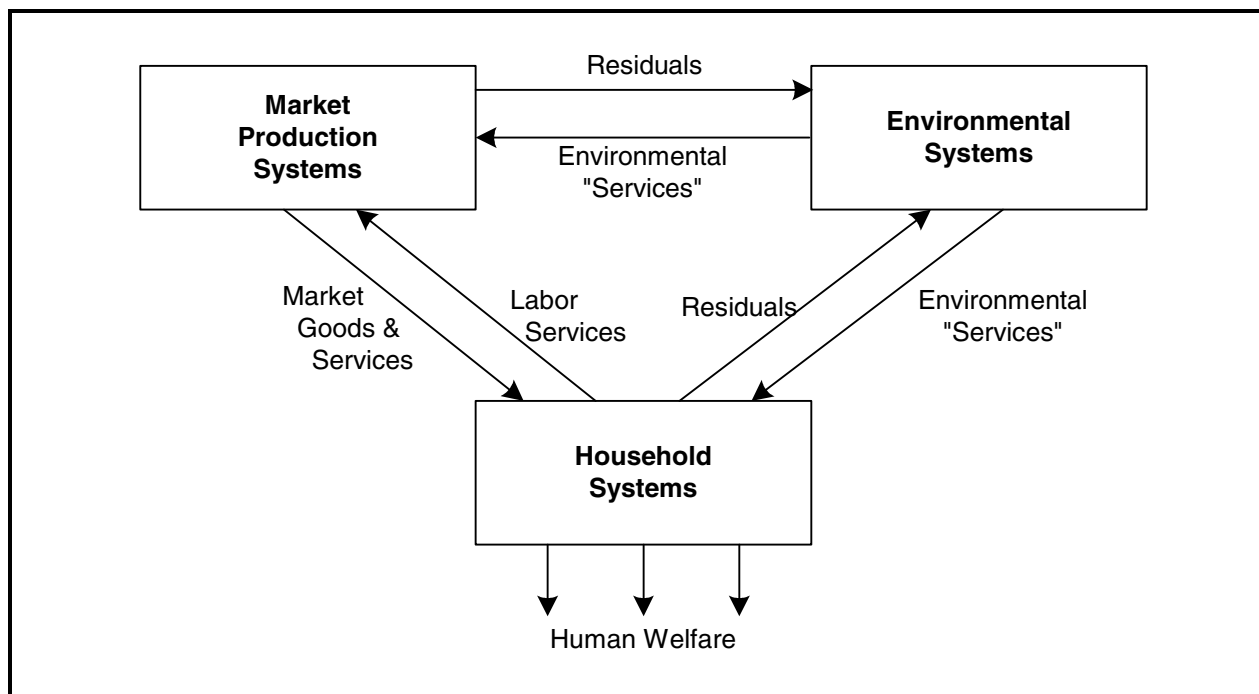
### 3.1 CONCEPTUAL BASIS FOR BENEFIT-COST ANALYSIS OF SNOWMOBILING RESTRICTIONS IN NATIONAL PARKS

According to the conceptual underpinnings of benefit-cost analysis, all social welfare impacts ultimately accrue to individuals. This is represented in Figure 3-1, which depicts flows of goods, services, and residuals among three major systems: market production, household, and the environment. Because these systems are closely interconnected, actions taken to reduce releases of harmful residuals (e.g., chemicals or noise pollution) to the environment potentially will reverberate throughout all of these systems. Nevertheless, the impacts of these actions, both the costs and benefits, will ultimately be experienced as changes in well-being for households/individuals. As a result, identifying and measuring costs and benefits must focus on these changes in well-being.

*The most direct impact will be on snowmobiling households, whose recreational opportunities will be partially constrained by the restrictions.*

The conceptual framework depicted in Figure 3-1 therefore provides a basis for assessing the costs and benefits of snowmobiling restrictions in national parks. In these cases, the most direct impact will be on snowmobiling households, whose recreational opportunities will be partially constrained by the restrictions. This will directly result in welfare losses to these households. In addition, the resulting changes in the behavior of these households are likely to affect environmental systems and market systems. Effects on these systems will indirectly affect the welfare of other households. For example, the park environment may be improved, and this change will enhance the “services” (primarily recreation-related) that the park provides to other households and individuals in society. On the other hand, the resulting reduction in the market demand for snowmobile-related goods and services will have negative impacts for those who own or work for establishments supplying these services. These types of direct and indirect impacts are identified and evaluated as part of this benefit-cost analysis.

**Figure 3-1. Interrelationship Among Market, Environmental, and Household Systems and Social Welfare**



Estimating the value of costs and benefits also requires methods for expressing welfare changes in monetary terms. In certain instances, welfare changes are directly the result of monetary gains or losses and can therefore be thought of as being equivalent to these gains or losses. For example, welfare losses to snowmobile rental shops due to reductions in demand for their services can be reasonably measured as their resulting net loss in income. In other instances, welfare changes are not directly associated with pecuniary gains or losses. Such “nonmarket” changes might, for example, include the welfare gains from improved recreational opportunities in a park. In these cases a surrogate measure of gains or losses must be used; willingness to pay (WTP) is such a surrogate. Economists and other practitioners of benefit-cost analysis generally accept WTP as the conceptually correct measure for valuing changes in individuals’ welfare. WTP represents the maximum amount of money that an individual would be willing to forgo to acquire a specified change. As such it is the monetary equivalent of the welfare gain from the change.

Using this conceptual framework for identifying, measuring, and valuing changes in societal welfare, the remainder of this section, Appendix A, and Section 2.7 provide a more detailed discussion of:

- the types of benefits and costs associated with snowmobiling restrictions in national parks, and
- the approaches used in measuring these benefits and costs.

### **3.1.1 Social Benefits of Snowmobiling Restrictions**

Snowmobiling in national parks may be associated with a number of negative impacts on environmental resources and ecosystems. The extent to which adverse impacts will be realized is a function of several factors, including the level of use, the technology of the machines being used, and the extent to which users remain on designated trails. One result of any negative impacts that occur is that they impose welfare losses on individuals who value the parks’ environmental systems. The benefits of snowmobiling restrictions therefore can be thought of and measured as the reduction in these losses to society. In addition, snowmobiling can negatively impact society in ways that are not directly related to the environment; therefore, the benefits of snowmobiling restrictions must also include reductions in these nonenvironmental losses.



Table 3-1 provides a broad classification of the types of environmental and nonenvironmental impacts associated with snowmobile use in national parks. In this section, this classification is used to more completely identify, categorize, and describe the full range of potential benefits associated with snowmobiling restrictions at national parks in general.

**Table 3-1. Classification of Potential Negative Impacts from Snowmobile Use in National Parks**

Impact Categories	Examples of Impacts
Environmental impacts	
Aesthetic	Noise, visibility, odor
Human health	Through impacts to air and water quality
Ecosystems	Loss of or damage to habitat and wildlife
Nonenvironmental impacts	
Infrastructure	Costs of trail monitoring, maintenance, and law enforcement
Human safety	Accidents
Cultural, historical, and archeological	Physical damages

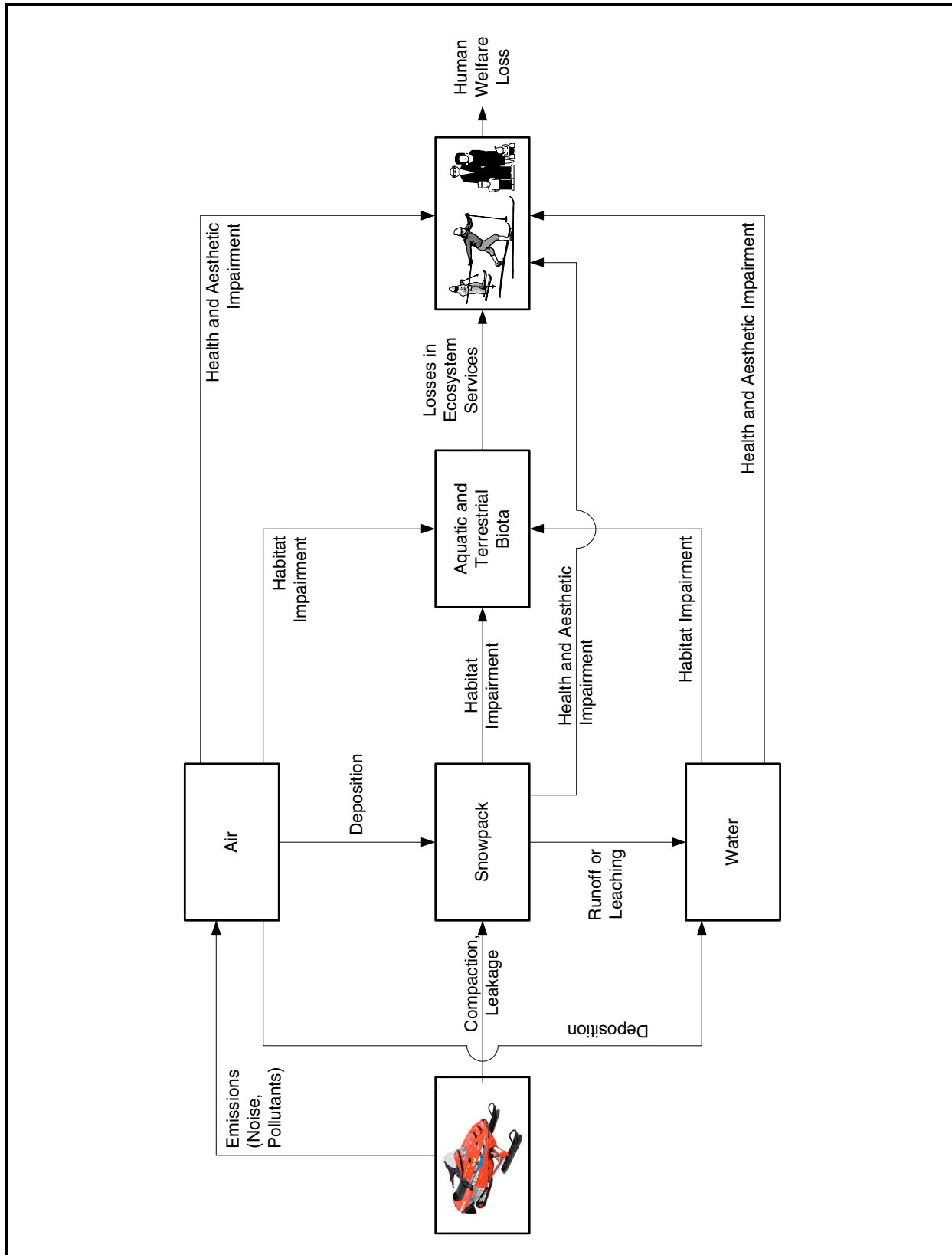
### **Environmental Benefits**

The use of snowmobiles may have adverse impacts on air quality, natural resources (e.g., water quality, habitat), wildlife, and natural quiet. Figure 3-2 depicts the various categories of potential adverse effects to the environment through which snowmobiles in national parks can impose welfare losses on society.

As described in Section 2.7, conventional snowmobiles create noise, and release substantial amounts of noise and pollutants into the environment. Noise from snowmobiles impairs the natural soundscape for park visitors and it has the potential to negatively affect wildlife in the park. Emissions from snowmobiles can also negatively affect park ecosystems, human health, and visitor experiences.

Pollutants are directly released to air and the snowpack, and they also have the potential to migrate to and contaminate water

**Figure 3-2. Routes of Environmental Damages and Human Welfare Losses from Snowmobiles in National Parks**



*From a benefit-cost perspective, those who ultimately benefit from actions to reduce impacts due to snowmobile use will be individuals who value the quality of the park environment.*

resources, primarily via deposition in the snowpack and subsequent melting into runoff.

As shown in Figure 3-2, all of these impacts can, directly or indirectly, lead to losses in human welfare. Therefore, from a benefit-cost perspective, those who ultimately benefit from actions to reduce these impacts will be individuals who value the quality of the park environment. Many of these beneficiaries will be park visitors whose recreational experiences are enhanced. As a point of reference, Table 3-2 reports average consumer surplus values that have been estimated for common (nonsnowmobiling) winter recreation activities. These are the types of recreation values that will be restored or even increased as a result of snowmobiling restrictions.

**Table 3-2. Summary of Average Recreation Values (2001\$ per person/day) for Selected Activities by Region<sup>a</sup>**

Activity	Study Location				National <sup>b</sup>	U.S. Average
	Northeast	Southeast	Mountain	Pacific		
Hiking/backpacking	50.80 (2)	124.12 (2)	42.24 (3)	23.02 (6)	23.56 (1)	45.59 (14)
Downhill ski			26.22 (2)	23.59 (1)	22.13 (1)	24.54 (4)
Cross-country ski	32.54 (2)		13.22 (1)		14.90 (1)	23.30 (4)

<sup>a</sup>All amounts were inflated using the consumer price index for recreation available from the Bureau of Labor Statistics (<<http://146.4.24/cgi-bin/surveymost>>). Numbers in parentheses represent the number of observations (i.e., studies).

<sup>b</sup>Studies estimating nationwide values.

Source: Rosenberger, Randall, and John Loomis. 2000. "Using Meta-Analysis for Benefit Transfer: In-Sample Convergent Validity Tests of an Outdoor Recreation Database." *Water Resources Research* 36(4):1097-1107.

Even individuals who are not park visitors (i.e., nonusers) can benefit from the knowledge that park resources are being protected and preserved. In other words, they may hold positive "nonuse values" (i.e., a positive WTP) for protecting the park environment. These nonuse values can stem from the desire to ensure others' enjoyment (both current and future generations) or from a sense that these resources have some intrinsic value. Evidence of such nonuse values for the protection of unique species and ecosystems has been documented in numerous studies (see e.g., Pearce and Moran [1994] for a review of such studies). Restrictions on snowmobile use in national parks can therefore provide benefits to

both users and nonusers in a number of ways by protecting the parks' ecological resources.

A more detailed discussion of the potential aesthetic, human health, and ecosystem benefits associated with restricting snowmobile use in national parks is provided in Section 2.7 and Appendix A.

### **Nonenvironmental Benefits**

In addition to wide-ranging environmental benefits, restrictions on snowmobile use in national parks can also improve societal welfare in ways that are not directly related to environmental quality in and around the parks. In particular, these restrictions can improve public safety in national parks, and they can reduce the costs of operating and maintaining the infrastructure necessary to support and monitor snowmobile use. Appendix A provides a more detailed discussion of the nonenvironmental benefits.

#### **3.1.2 Social Costs of Snowmobiling Restrictions**

The primary losses associated with snowmobiling restrictions in national parks will accrue to

- snowmobilers, in particular individuals who will not snowmobile in the park as a direct result of the restrictions, and
- providers of snowmobile-related services for park visitors.

The welfare losses to individual consumers (snowmobile riders) are measured by their loss in consumer surplus, while losses to producers are measured by their loss of producer surplus.

Appendix A provides more detail on measuring losses to consumers and producers.

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*Regulating snowmobile use in national parks may lead to decreased demand for snowmobile sales or rentals and increased demand for cross country ski sales or rentals or snowcoach rides.*

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#### **3.1.3 Identifying Relevant Benefits and Costs**

To conduct the benefit-cost analysis, the relevant benefits and costs must be identified. In this section, NPS discusses two economic concepts that are important for an analysis of the benefits and costs of the proposed snowmobile regulations: indirectly affected secondary markets and distorted primary markets. Often consumers and producers may be indirectly affected by a policy. For example, regulating snowmobile use in national parks may lead to decreased demand for snowmobile sales or rentals and increased demand for cross country ski sales or rentals or snowcoach rides.

Whether these indirect, or secondary, impacts should be included in the analysis depends on whether the change in demand or supply in the secondary market results in price changes (for details, see a benefit-cost analysis textbook such as Boardman et al. [1996]). In general when the policy change in the primary market causes prices to change in the secondary markets, the net change in social welfare from the secondary market should be included in the benefit-cost analysis. If prices do not change in the secondary market, the revenue gains or losses should not be included in the benefit-cost analysis. Without more detailed information, NPS is unable to predict whether the proposed delay rule will change prices for snowmobile sales or rentals. Thus, losses or gains to businesses that may be indirectly affected by the proposed rule are included in the benefit-cost analysis.

Distorted primary markets are also important in analyzing the impact of the proposed snowmobile regulations. As described above, snowmobile use may generate negative externalities, such as air pollution and noise that affect other park visitors and park resources. If snowmobiles do generate negative externalities, then the private cost of using a snowmobile (the cost to the individual snowmobile user) will be lower than the social cost of snowmobile use (where the social cost of snowmobile use includes both the cost to the snowmobile user plus the costs to others that result from the negative externalities associated with snowmobile use). Because snowmobile users do not have to pay the full social cost of using a snowmobile and instead only pay the lower, private cost, snowmobile use will be higher than socially optimal. In addition, measures of net consumer surplus to snowmobile riders that do not account for the additional costs imposed on society by the negative externalities associated with snowmobile use will overstate the true net social welfare associated with the activity.

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### **3.2 RESULTS FOR YNP, GTNP, AND THE PARKWAY**

Based on the approach and possible impacts outlined above, this section presents the results of the benefit-cost analysis for YNP, GTNP, and the Parkway. This section discusses the groups most directly affected by the proposed change in regulation and several

scenarios for the possible levels of impacts. The benefits and costs accruing to these groups are then presented.

### **3.2.1 Affected Groups**

For the purpose of this study, seven major affected groups, listed in Table 3-3, have been identified:

1. Snowmobile riders, in particular those who currently ride in YNP, GTNP, or the Parkway or in areas where riders turned away from the parks will go instead of YNP, GTNP, or the Parkway.
2. Other visitors (nonsnowmobilers) or potential visitors who may have a different experience at the park if snowmobiles are restricted or banned in YNP, GTNP, or the Parkway.
3. Summer visitors who may have a different experience in the park if the overall environmental quality of the park improves.
4. The general public who may care about YNP, GTNP, or the Parkway, even when they do not visit.
5. Producers of snowmobile services in the towns of the five-county area who may experience a change in their welfare.
6. Producers of services to other types of winter visitors (for example, cross county ski or snowshoe rentals or snowcoach tours) who may experience a change in their welfare.
7. Residents of West Yellowstone, Montana, who may experience less traffic congestion, air pollution, and noise if fewer snowmobiles ride on the town's streets. (Note that these same people may also lose or gain consumer surplus and producer surplus to the extent that they fall into other categories in Table 3-3.)

For each group, Table 3-3 summarizes possible changes in activity from implementing the delay rule and resulting changes in welfare, whether consumer surplus or producer surplus. The impact on each group is discussed in detail below.

**Table 3-3. Affected Groups**

Group	Activity under Baseline January 2001 Rule	Change in Activity under the Delay Rule	Change in Welfare under the Delay Rule
1. Snowmobile riders	Winter 2002–2003: Limits on the number of riders in the parks and a requirement for guided tours in YNP. Winter 2003–2004: Snowmobiles banned from the park.	Winter 2002–2003: No limits on the number of riders in the parks and no requirement for guided tours. Winter 2003–2004: Limits on the number of riders in the parks and a requirement for guided tours in YNP.	Winter 2002–2003: Consumer surplus increases for riders who would have been turned away from the parks in winter 2002–2003 due to limits set for each entrance. Winter 2003–2004: Consumer surplus increases for those riders who would have been turned away from the park due to the ban, up to the limits set for each entrance. The impact of guided tours on consumer surplus is unclear. Some riders will prefer the tours while others will not. Snowmobile riders who currently ride in areas that offer a substitute to YNP, GTNP, and the Parkway for riders excluded from these parks will gain consumer surplus if the areas they visit remain less crowded for an additional year under the delay rule.
2a. Other current winter visitors	Increase visitation to YNP, GTNP, and/or the Parkway in winters 2002–2003 and 2003–2004 relative to baseline levels.	Reduce visitation to YNP, GTNP, and/or the Parkway in winters 2002–2003 and 2003–2004 relative to activity under the January 2001 rule.	Consumer surplus decreases in the winters of 2002–2003 and 2003–2004 due to higher numbers of snowmobile riders in the park (subjecting these visitors to more negative externalities) and lower visitation for this group.
2b. Potential winter visitors	Visit YNP, GTNP, or the Parkway in winters 2002–2003 and 2003–2004.	Visit other recreational sites in winters 2002–2003 and 2003–2004.	Consumer surplus decreases for visitors who would have visited the parks if snowmobile use was restricted or eliminated.
3. Summer visitors	Visit YNP, GTNP, or the Parkway in summer 2002–2003 and 2003–2004.	None	Consumer surplus decreases (if environmental degradations occur as a result of delaying restrictions on snowmobile use in the winter).
4. General public who may care about the natural resources in the parks even if they do not visit	Not visiting YNP, GTNP, or the Parkway	None	Consumer surplus decreases for people who hold nonuse value for the natural resources in YNP, GTNP, or the Parkway (if environmental degradations occur as a result of delaying restrictions on snowmobile use in the winter).

(continued)

**Table 3-3. Affected Groups (continued)**

Group	Activity under Baseline January 2001 Rule	Change in Activity under the Delay Rule	Change in Welfare under the Delay Rule
5. Owners of snowmobile rental shops	Rent or sell fewer snowmobiles	Rent or sell additional snowmobiles	<p>Producer surplus increases in the winter of 2002–2003 for shops that would have lost revenue from the baseline restrictions limiting the number of snowmobiles in the parks and requiring guided tours in YNP.</p> <p>Producer surplus increases for shops with concessions to offer guided tours in the winter of 2003–2004 who would have lost revenue under the ban on snowmobile use in the baseline January 2001 regulation.</p>
Owners of hotels, restaurants, gift shops	Support fewer snowmobile riders	Support more snowmobile riders	<p>Producer surplus increases in the winters of 2002–2003 and 2003–2004 for businesses that would have lost revenue in those winters from a decline in total visitation.</p>
6. Owners of ski, snowshoe rental, and snowcoach shops	Support more other winter visitors	Support fewer other winter visitors	<p>Producer surplus decreases if the number of other winter users does not increase during the winters of 2002–2003 and 2003–2004 to the extent that would have happened under the baseline rule.</p> <p>Snowcoach tour operators will lose producer surplus under the delay rule in the winters of 2002–2003 and 2003–2004 resulting from delayed implementation of the baseline rule under which snowcoaches will be the only motorized vehicles in the parks.</p>
7. Residents of West Yellowstone, Montana	Reside in West Yellowstone	None	<p>Consumer surplus decreases because of more traffic, noise, and other snowmobile-related disamenities in the winters of 2002–2003 and 2003–2004.</p> <p>Consumer surplus will increase to the extent that tax revenue available to fund public services will be higher under the delay rule for the winters of 2002–2003 and 2003–2004 assuming that the restrictions on snowmobile use will result in fewer visitors to West Yellowstone.</p>



### **3.2.2 Scenarios**

Analysis of the changes in welfare to both riders and business owners requires predicting the likely impact of the delay rule relative to the January 2001 rule. In the 2004–2005 winter season and all subsequent winter seasons, the use restrictions are identical under either rule. However, differences prior to that period will lead to differences in welfare impacts between the two rules. Because it is not known exactly how winter visitation to the five-county GYA will change in 2002–2003 and 2003–2004 as a result of delaying the restrictions on winter use by one year, three scenarios were developed for each year to provide a range of possible outcomes. It is assumed that snowmobilers who previously visited YNP, GTNP, and/or the Parkway will decrease their visitation to the parks as a result of the regulation, but they will not necessarily stop visiting the area altogether; the number of snowmobilers who continue to visit the area differs under each scenario (see below). It is likely that some of these snowmobilers will substitute snowmobile trips into surrounding national forests for trips into the parks because of the close proximity of national forest lands. Others are likely to substitute snowcoach tours or guided snowmobile tours for unguided trips.<sup>1</sup> Even some of the snowmobilers who will no longer use motorized vehicles in the parks because of the restriction may continue to visit the five-county GYA to enjoy other recreational activities.

It is assumed that people who continue to visit the area will have the same spending pattern as previously, except that some of them will no longer rent unguided snowmobiles and some may increase expenditures on snowcoaches or guided snowmobile tours.<sup>2</sup> This group of current snowmobilers that continues to visit the area may engage in other winter recreational activities and may increase expenditures on those activities, but this potential increase in spending is included only for snowcoaches and guided snowmobile

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<sup>1</sup>In the years prior to the ban (i.e., 2002–2003 for the January 2001 rule and 2003–2004 for the delay rule), in addition to entrance limits, snowmobiles are allowed into YNP only with an NPS-approved guide. Although snowcoach tours will be available indefinitely under either regulation, guided snowmobile tours are not permitted after the 2002–2003 and 2003–2004 seasons for the January 2001 rule and delay rule, respectively.

<sup>2</sup>In some cases, visitors that previously rented unguided snowmobiles may begin going on guided snowmobile tours. These tours are more expensive and will increase expenditures on snowmobile rentals for those people.

tours because there is no information on what would be spent on other activities (such as cross-country skiing). In addition, the number of nonsnowmobilers visiting the five-county GYA may increase because any reductions in noise and pollution expected to result from these regulations will likely increase their enjoyment of the area. However, this increase was not included in the analysis because little information on the extent to which this effect would take place was available.

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*All scenarios are estimated in terms of the difference in winter use patterns between the January 2001 rule and the delay rule.*

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All scenarios are estimated in terms of the difference in winter use patterns between the January 2001 rule and the delay rule. For example, delaying the implementation of the ban on snowmobiles from the parks will tend to increase the number of snowmobile rentals in 2002–2003 relative to the January 2001 rule, while it will decrease the number of snowcoach tours relative to the case where snowmobiles face limits.<sup>3</sup>

### **Baseline Visitation**

Approximately 99,169 people entered the national parks in the GYA on a snowmobile in the winter of 2000–2001.<sup>4</sup> Based on survey results from Borrie et al. (1999), it was assumed that about 70 percent of snowmobilers in the parks use rented machines. This implies that 29,751 visitors rode privately owned snowmobiles and that 69,418 of these winter visitors entered the parks on rented snowmobiles. Data from YNP on the total number of snowmobile riders and snowmobiles that entered YNP in 2000–2001 (84,971 and 67,793, respectively) indicates that the overall average number of visitors per snowmobile (renters and owners) for all parks is approximately 1.25.<sup>5</sup> Based on this ratio of visitors to snowmobiles, NPS assumed that the 29,751 owners rode a total of

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<sup>3</sup>For businesses that provide both snowmobile rentals and snowcoach tours, they may either gain or lose from the delay rule depending on the relative size of the producer surplus change for each market in which they operate.

<sup>4</sup>This number is based on visitation numbers in Section 2.4.2 adjusting total reported snowmobile visitation for YNP, GTNP, CDST, and the Parkway by subtracting the number of snowmobile visitors using the south entrance of YNP. This adjustment was made based on input from park officials who indicated that these machines would otherwise be double-counted.

<sup>5</sup> This ratio (and others presented in the text) is the rounded value; in subsequent calculations, the actual value, as opposed to the rounded value, was used. Although this implies the values of these data are more precisely known than they actually are, this was done to avoid the introduction of multiple rounding errors. As a result, the reader may not be able to calculate exactly the same numbers presented in the text.

23,736 machines into the parks in 2000-2001. In addition, the 69,418 snowmobile renters entering the parks in 2000-2001 were assumed to be riding 55,384 machines. Reports filed with the three parks by their licensed concessionaires in 1998-1999 indicated that approximately 27.5% of all rented snowmobiles entering the parks were on guided tours, and that there were an average of approximately 1.15 visitors per snowmobile. Assuming that both the percentage of rented snowmobiles on guided tours and the average number of people per guided snowmobile are representative of any year, NPS estimated that 15,231 guided, rented machines were used in the parks in 2000-2001, and that they carried 17,455 guided rental visitors. Of the total rental visitors in winter 2000-2001, this leaves 51,963 visitors who entered the parks on 40,154 rented but unguided machines.<sup>6</sup>

Based on the projections presented in Section 2.4.3, the number of snowmobilers will increase to 104,322 in 2002-2003 and 107,030 in 2003-2004. NPS assumed that the number of people per machine, the percentage of snowmobilers that are renters, and the percentage of rented snowmobiles that are used on guided tours all remain constant at the values presented above for 2000-2001. This implies that there would be 31,297 visitors riding 24,970 privately owned snowmobiles in 2002-2003 and 32,109 visitors riding 25,618 privately owned snowmobiles in 2003-2004 in the absence of restrictions on snowmobiling. There would also be 18,362 people using 16,022 snowmobiles for guided tours and 54,663 visitors using 42,240 unguided rental snowmobiles in 2002-2003. In 2003-2004, these values are projected to increase to 18,839 people on guided tours (using 16,438 snowmobiles) and 56,083 visitors using unguided rentals (43,337 snowmobiles).

The total changes in unguided snowmobile rentals, guided snowmobile rentals, and snowcoach use for each scenario were calculated separately for snowmobile owners and renters based on the assumed percentage reductions in visitation resulting from restrictions on winter use in the parks (see Table 3-4 below). The scenarios also assume that the number of visitors per snowmobile will increase to 1.45 people per snowmobile under the regulations for people who continue to visit the GYA on snowmobiles after

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<sup>6</sup> This results in approximately 1.29 visitors per rented, unguided snowmobile.

switching from unguided to guided machines (based on the current proportion of single and double passenger machines available for rent).<sup>7</sup> Finally, it was assumed that all snowmobile owners are GYA residents and all snowmobile renters are nonresidents.

### **Scenarios for 2002–2003**

The scenarios that were analyzed for the affected parks during 2002–2003 are summarized in Table 3-4. As modeled in the following scenarios, the impacts affect only visitation to YNP, so the percentage changes in Table 3-4 apply to YNP visitation numbers (see footnote a in Table 3-4). The scenarios are presented as the changes in winter use patterns estimated to occur under the January 2001 rule, e.g., the impact of the delay rule in 2002–2003 is to avoid the impacts that would have occurred under the January 2001 rule. In other words, any negative impacts that would have occurred in 2002–2003 under the January 2001 rule would be postponed under the delay rule. On the other hand, positive impacts on certain businesses that would have occurred under the January 2001 rule would also be delayed. Thus, the changes in visitation due to the delay rule relative to the January 2001 rule are equal in absolute value to the changes presented in Table 3-4, but with the opposite sign (gains become losses and vice versa). Overall, delaying the restrictions is estimated to have positive economic impacts on local businesses as discussed in Section 3.2.3.

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<sup>7</sup> This increase in the estimated number of people per snowmobile is based on the expectation that as the number of snowmobiles entering YNP was limited, visitors would be likely to increase the number of people per machine to ensure access for their entire party. However, it was assumed that those people who take guided rentals in the baseline or who substitute snowmobiling trips in the GYA outside the parks would continue having the same number of people per snowmobile as in the baseline.

**Table 3-4. Summary of Scenarios Used in Analyzing Economic Impacts of January 2001 Rule on Five-County GYA in 2002–2003<sup>a</sup>**

	Scenario 1	Scenario 2	Scenario 3
Percentage change in visitation to five-county GYA by snowmobile owners using their personal machines	–31.2%	–12.7%	–10%
Percentage change in unguided snowmobile rentals	–90%	–85%	–80%
Percentage change in renters visiting five-county GYA	–10%	–10%	–10%
Percentage of snowmobile renters switching to snowcoaches	10%	10%	10%
Percentage of snowmobile owners switching to snowcoaches	0%	2.5%	5%
Percentage of snowmobile owners switching to guided snowmobile rentals	0%	5%	10%
Change in the number of visitors renting unguided snowmobiles	–38,775	–36,621	–34,467
Change in the number of visitors (renters and owners combined) renting guided snowmobiles <sup>b</sup>	24,904	24,904	24,904
Change in the number of visitors (renters and owners combined) riding snowcoaches	4,308	4,966	5,625
Total change in snowmobile owner visitation to the GYA	–8,216	–3,344	–2,633
Total change in snowmobile renter visitation to the GYA	–4,308	–4,308	–4,308
Total change in number of visitors to five-county GYA	–12,524	–7,653	–6,942

<sup>a</sup> Based on current visitation in all 3 parks, the entry limits, and the requirement for guided tours in YNP, the impacts of the January 2001 rule in winter 2002–2003 are assumed to affect only snowmobile riders who enter YNP because limits are not expected to be binding in GTNP/Parkway. The percentage change in participation in different activities are applied to estimates of the number of snowmobile owners in YNP (26,334), the number of unguided renters in YNP (43,083), and the number of guided rentals in YNP (18,362).

<sup>b</sup> The number of renters who are assumed to switch from unguided to guided tours is the residual after subtracting the number of renters who currently take guided tours plus the number of owners who switch to guided tours from the estimate of the number of machines allowed in YNP under the limits set in the January 2001 rule assuming 1.45 people per machine.

In all three scenarios, it was assumed that at least some of the affected snowmobile owners and renters would continue to visit the five-county GYA for other activities.<sup>8</sup> The percentage reductions in snowmobile owners visiting the GYA for Scenarios 1 and 2 are based on results from a survey from Duffield and Neher (2000). For Scenario 1, the reduction in owners is based on the percentage of resident<sup>9</sup> winter visitors that indicated they would reduce their visitation under a ban on snowmobile usage in YNP (from Table 4.15 in Duffield and Neher [2000]).<sup>10</sup> Scenario 2 assumes percentage reductions in visitation for owners equal to the net reduction in winter visitation by residents accounting for visitors who said they would increase their visits under the proposed rule (from Table 4.17 in Duffield and Neher [2000]). Finally, in Scenario 3, it was assumed that the great majority of snowmobilers currently visiting the parks would visit the GYA even if they could not snowmobile in the parks. This scenario assumes that it is much more important to visitors currently entering the park on snowmobiles to be able to spend time in the GYA than to snowmobile in the parks. In this case, it was assumed that only 10 percent of owners will no longer visit the five-county GYA following the proposed restrictions on snowmobiles.

Based on the presumption that snowmobile owners are experienced snowmobilers who are unlikely to be willing to rent snowmobiles to participate in guided tours through YNP<sup>11</sup> or to ride on snowcoaches, it was assumed that few would be willing to use those alternatives. For Scenarios 1, 2, and 3, respectively, it was estimated that 0, 5, and 10 percent of snowmobile owners would be willing to go on guided snowmobile tours in 2002–2003. It was

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<sup>8</sup>They may be snowmobiling in areas within the five-county area that are outside the parks, or they may be engaging in alternative winter activities inside the five-county area either inside or outside of the national parks.

<sup>9</sup>It was assumed that all snowmobile owners are residents of the GYA, and all snowmobile renters are nonresidents for simplicity. However, there are certainly exceptions to this assumption.

<sup>10</sup>The changes in visitation to the GYA from Duffield and Neher (2000) are for the 17-county GYA and may understate the reduction in visitation to the five-county GYA.

<sup>11</sup>It is possible that some firms offering guided tours would permit people to use their own machines instead of renting their snowmobiles. However, based on interviews with local rental shops, it is unlikely that many shops would offer this option. In addition, those firms that said they would consider allowing people to use their own machines for guided tours indicated they would do so only if they had room on their tours (i.e., less than 11 rental sleds).

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*Under all three scenarios, it was assumed that total visitation to the GYA by those currently renting unguided snowmobiles would decline by only 10 percent.*

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also estimated that 0, 2.5, and 5 percent of baseline snowmobile owners would be willing to switch to snowcoaches in 2002–2003 under Scenarios 1, 2, and 3.

For those visitors renting unguided snowmobiles prior to regulation, it was assumed that relatively few would be willing to continue renting them to travel to the national forests or other locations within the GYA but outside the national parks. This is based on the expectation that visitors from outside the region will generally be much more interested in visiting the parks to enjoy alternative activities inside the parks than snowmobiling outside the parks. Therefore, NPS assumed that there would be reductions in the total number of unguided rentals that previously entered YNP of 90, 85, and 80 percent, respectively, for Scenarios 1, 2, and 3.<sup>12</sup> However, under all three scenarios, it was assumed that total visitation to the GYA by those currently renting unguided snowmobiles would decline by only 10 percent. For those visitors that no longer rent unguided snowmobiles, it is expected that they will substitute guided snowmobile tours (in the year prior to the ban), snowcoach tours, or other winter activities. It was assumed that 10 percent of former unguided snowmobile renters would switch to riding snowcoaches under each scenario, that enough of them would switch to guided rentals to reach the cap on snowmobile visitation at each YNP entrance, and that additional visitors would continue to visit the GYA for alternative activities such that total visitation by current renters would be 90 percent of current visitation following implementation of limits and guided tours in 2002–2003.

Table 3-5 compares the winter activities estimated for snowmobile owners and renters who currently visit the national parks under the January 2001 rule and the delay rule. This table shows the reallocation of current snowmobile owners and renters among the categories listed based on the regulations that will go into effect and the assumptions discussed above. Recall that snowmobile owners who continue to ride in YNP under the January 2001 rule are assumed to rent machines as part of a guided tour (because

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<sup>12</sup>In all three scenarios, the number of unguided rentals to YNP falls by 100 percent because they are no longer allowed in the park under the January 2001 rule. However, unguided rentals fall by less than 100 percent because some of the visitors that currently rent unguided snowmobiles to visit YNP are expected to substitute trips within the GYA outside the parks.

**Table 3-5. Comparison of Winter Activity in 2002–2003 Under the January 2001 Rule and the Delay Rule**

		January 2001 Rule		
	Delay Rule	Scenario 1	Scenario 2	Scenario 3
Current Snowmobile Owners				
Snowmobile in YNP with personal machines on unguided trips	26,334	0	0	0
Snowmobile in GTNP/Parkway with personal machine	4,963	4,963	4,963	4,963
Snowmobile in YNP with guided rental	0	0	1,317	2,633
Ride snowcoach in parks	0	0	658	1,317
Use personal snowmobile in GYA outside parks	0	18,118	21,014	19,750
Continue to visit parks for nonmotorized activities <sup>a</sup>	0	0	0	0
Do not visit GYA	0	8,216	3,344	2,633
Total	31,297	31,297	31,297	31,297
Current Snowmobile Renters				
Snowmobile in YNP with unguided rental	43,083	0	0	0
Snowmobile in GTNP/Parkway with unguided rental	11,580	11,580	11,580	11,580
Snowmobile in YNP with guided rental	18,362	43,266	41,949	40,632
Ride snowcoach in parks	0	4,308	4,308	4,308
Use unguided rental in GYA outside parks	0	4,308	6,463	8,617
Continue to visit parks for nonmotorized activities	0	5,255	4,417	3,580
Do not visit GYA	0	4,308	4,308	4,308
Total	73,025	73,025	73,025	73,025

<sup>a</sup>This does not imply that snowmobile owners do not visit the parks for nonmotorized activities but reflects an assumption that they will not substitute a nonmotorized visit to the park for a motorized visit.

snowmobiles are required to be accompanied by an NPS-approved guide in the year prior to the ban).

Table 3-6 provides the incremental impacts on winter use patterns of replacing the January 2001 rule with the delay rule. The projected users in Table 3-6 are calculated by subtracting the number of people pursuing a particular activity under the January 2001 rule from the number pursuing the same activity under the delay rule.



**Table 3-6. Incremental Effects of the Delay Rule in 2002–2003**

	Scenario 1	Scenario 2	Scenario 3
<b>Current Snowmobile Owners</b>			
Snowmobile in YNP with personal machine on unguided trips	26,334	26,334	26,334
Snowmobile in GTNP/Parkway with personal machine	0	0	0
Snowmobile in YNP with guided rental	0	–1,317	–2,633
Ride snowcoach in parks	0	–658	–1,317
Use personal snowmobile in GYA outside parks	–18,118	–21,014	–19,750
Continue to visit parks for nonmotorized activities <sup>a</sup>	0	0	0
Do not visit GYA	–8,216	–3,344	–2,633
<b>Current Snowmobile Renters</b>			
Snowmobile in YNP with unguided rental	43,083	43,083	43,083
Snowmobile in GTNP/Parkway with unguided rental	–24,904	–23,587	–22,270
Snowmobile in YNP with guided rental	0	0	0
Ride snowcoach in parks	–4,308	–4,308	–4,308
Use unguided rental in GYA outside parks	–4,308	–6,463	–8,617
Continue to visit parks for nonmotorized activities	–5,255	–4,417	–3,580
Do not visit GYA	–4,308	–4,308	–4,308

<sup>a</sup>This does not imply that snowmobile owners do not visit the parks for nonmotorized activities but reflects an assumption that they will not substitute a nonmotorized visit to the park for a motorized visit.

For example, under Scenario 1 in Table 3-6 there will be 26,334 more snowmobile owners using their machines in YNP for unguided tours under the delay rule than under the January 2001 rule (which requires guided tours for snowmobile riders). Of these 26,334 owners, 18,118 would have used their machines outside the parks in the GYA and 8,216 would not have visited the GYA under the January 2001 rule for Scenario 1 (these are negative values in Table 3-6).

### **Scenarios for 2003–2004**

The scenarios for 2003–2004 (Table 3-7) were all estimated relative to the scenarios generated for 2002–2003. Under the January 2001 rule, no snowmobiles would be allowed in the parks, so all snowmobile owners still using their machines in GTNP and the Parkway in 2002–2003 are assumed to respond in one of three

ways in 2003–2004: ride snowcoaches in the parks, use their snowmobiles outside the parks, or reduce visitation to the GYA.<sup>13</sup>

It was assumed that snowmobile owners using their personal machines in the GYA in 2002–2003 under the January 2001 rule would substitute alternatives in the same proportions for 2003–2004 as assumed for 2002–2003. As discussed above, the percentage reductions assumed for snowmobile owners for Scenarios 1 and 2 were based on the results of a survey by Duffield and Neher (2000), while for Scenario 3 they were based on the assumption that the great majority of snowmobilers in the parks would continue to visit even if they could no longer snowmobile. For those snowmobile owners who switched to guided snowmobile tours in 2002–2003, it was assumed that 50 percent would switch to snowcoaches in 2003–2004 when guided rentals were no longer available. The percentage willing to shift from guided rentals to snowcoaches was far higher than that used for substitution between unguided rentals and snowcoaches based on the assumption that those baseline snowmobile owners that are willing to switch to guided rentals place great importance on visiting the parks and would be more far more likely than the average snowmobile owner to ride snowcoaches to ensure continued motorized access to the parks.

For renters, it was assumed that those people renting either guided or unguided snowmobiles in 2002–2003 would respond in a similar fashion to one another in 2003–2004. Based on an earlier report analyzing the impacts of the January 2001 rule (NPS, 2001), 29, 43, and 65 percent of guided and unguided rentals in 2002–2003 were assumed to switch to riding snowcoaches in 2003–2004 under the January 2001 rule (when snowmobiles are no longer allowed in the parks) for Scenarios 1, 2, and 3, respectively. Just as described in the scenarios above for 2002–2003, it was assumed that 10, 15, and 20 percent of rentals traveling to the park in 2002–2003 would substitute areas outside the parks in 2003–2004 for the three scenarios. Based on survey results from Duffield and Neher (2000), it was assumed that 45.8 percent of snowmobile renters will

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<sup>13</sup>It is also possible that they would substitute alternative nonmotorized activities. However, it was assumed that snowmobile owners would not substitute nonmotorized trips for motorized trips. This does not imply that snowmobile owners do not make nonmotorized trips to the parks or to the GYA, only that they would not substitute a nonmotorized trip for a current motorized trip.

no longer visit the GYA under Scenario 1 if snowmobiles are no longer permitted and 31.6 percent will no longer visit under Scenario 2. Scenario 3 is based on the assumption that the parks are important enough to visitors that only 10 percent of 2002–2003 renters will no longer visit the parks if snowmobiles are not permitted. The remainder of 2002–2003 snowmobile renters that continue to visit the GYA region are assumed to switch to unguided rentals outside the park, snowcoach rides, or alternative activities within the GYA.

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*Snowmobile owners are more likely to be residents wishing to snowmobile, while renters are more likely to want to visit the parks.*

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Owners were generally assumed to be more likely than renters to switch to snowmobiling in other locations within the five-county GYA (i.e., less likely to reduce visitation to the area). This assumption was made because snowmobile owners are presumably more experienced and well prepared for national forest trips than snowmobile renters and may be more willing to switch. Owners are also more likely to be residents wishing to snowmobile, while renters are more likely to specifically want to visit the parks, and snowmobiles happen to be one way to travel in the parks. For these renters, snowmobiling is the mode of transportation, and they may be less focused on snowmobiling, per se, than the owners. Therefore, renters will presumably be more willing to substitute snowcoach tours as a way of seeing the parks.

The scenarios developed for 2003–2004 under the January 2001 rule are summarized in Table 3-7. Note that all of the percentage changes in visitation apply only to those people that are undertaking those activities in 2002–2003 under the January 2001 rule. For example, although there are no longer snowmobile owners using their personal machines in YNP in 2002–2003, they can continue to use them in GTNP and the Parkway. Thus, the percentage change in visitation to the GYA by snowmobile owners in 2003–2004 applies to those that are still visiting the parks in 2002–2003 only. Those current snowmobile owners and renters that switched to alternative activities already in 2002–2003 are assumed to continue that alternative activity in 2003–2004.

**Table 3-7. Summary of Scenarios Used in Analyzing Economic Impacts of January 2001 Rule on Five-County GYA in 2003–2004 (Relative to 2002–2003 Estimates)**

	Scenario 1	Scenario 2	Scenario 3
Percentage change in visitation to five-county GYA by snowmobile owners using their personal machines in the parks in 2002–2003	–31.2%	–12.7%	–10%
Percentage change in visitation to five-county GYA by 2002–2003 guided and unguided snowmobile renters riding in the parks in 2002–2003	–45.8%	–31.6%	–10%
Percentage change in 2002–2003 guided and unguided snowmobile rentals in the parks	–90%	–85%	–80%
Percentage of 2002–2003 guided and unguided snowmobile rentals riding in the parks that will switch to snowcoaches	29%	43%	65%
Percentage of 2002–2003 snowmobile owners using their personal machines in the parks switching to snowcoaches	0%	2.5%	5%
Percentage of snowmobile owners that switched to guided tours in 2002–2003 that now switch to snowcoaches	50%	50%	50%
Change in the number of people renting unguided snowmobiles <sup>a</sup>	–6,095	–1,396	3,171
Change in the number of visitors (owners and renters combined) renting guided snowmobiles	–43,266	–43,266	–43,266
Change in the number of visitors (owners and renters combined) riding snowcoaches	15,905	23,827	35,558
Total change in snowmobile owner visitation to five-county GYA	–1,755	–714	–562
Total change in snowmobile renter visitation to five-county GYA	–25,119	–16,915	–5,221
Total reduction in number of visitors to five-county GYA	–26,874	–17,629	–5,784

<sup>a</sup>Calculated as difference between the number of people who rode unguided rentals in GTNP/Parkway and outside the parks in the GYA under the January 2001 rule in winter 2002–2003 and the number of people who rent snowmobiles to ride outside the parks in the GYA in 2003–2004 assuming that between 10 and 30 percent (for Scenarios 1 through 3) of all the snowmobiles (guided and unguided) riding in the parks in 2002–2003 would switch to riding outside the parks under the ban.

Note: All changes in winter use patterns used in the 2003–2004 scenarios are relative to changes in visitation estimated for 2002–2003 for the same scenario. Tables 3-8 and 3-9 provide a breakdown of numbers.

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*If fewer people are willing to continue visiting the area and switch from snowmobiling in the parks to other locations within the five-county GYA than assumed above, the overall impact of the delay rule on the region will be larger, other things being equal.*

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Table 3-8 compares the winter activities estimated for snowmobile owners and renters who currently visit the parks under the January 2001 rule and the delay rule. This table shows the reallocation of snowmobile owners and renters among the listed categories of activities based on the regulations in place and the assumptions discussed above. Table 3-9 provides the incremental economic impacts in 2003–2004 of replacing the January 2001 rule with the delay rule, assuming visitation in 2002–2003 is consistent with Table 3-5 for the respective scenarios. Again, for this analysis NPS assumed that the limited numbers of snowmobile owners who continue to ride in YNP under the delay rule rent machines as part of a guided tour (because snowmobiles must be accompanied by an NPS-approved guide in the year before the ban).

These scenarios are used in the following section to provide a range of potential economic impacts resulting from implementation of the delay rule. Clearly, if fewer people are willing to continue visiting the area and switch from snowmobiling in the parks to other locations within the five-county GYA such as the national forests than assumed above, the overall impact of the delay rule on the region will be larger, other things being equal. Similarly, the more people who are willing to switch to alternative winter recreation activities within the area among former snowmobilers, the smaller the impact will be. Thus, the economic impact of this regulation depends crucially on snowmobilers' willingness to substitute recreational trips into alternative snowmobiling destinations in the region for recreational trips into the parks and the willingness of snowmobilers to substitute other recreational activities available within the area, including the use of snowcoaches in the parks, for snowmobiling.

**Table 3-8. Comparison of Winter Activity in 2003–2004 Under the January 2001 Rule and the Delay Rule**

	Delay Rule			January 2001 Rule		
	Scenario 1	Scenario 2	Scenario 3	Scenario 1	Scenario 2	Scenario 3
<b>Current Snowmobile Owners</b>						
Snowmobile in YNP with personal machine on unguided trips	0	0	0	0	0	0
Snowmobile in GTNP/Parkway with personal machine	5,176	5,176	5,176	0	0	0
Snowmobile in YNP with guided rental	0	1,339	2,678	0	0	0
Ride snowcoach in parks	0	670	1,339	0	1,468	2,937
Use personal snowmobile in GYA outside parks	18,577	21,523	20,237	22,138	26,582	25,976
Continue to visit parks for nonmotorized activities <sup>a</sup>	0	0	0	0	0	0
Do not visit GYA	8,356	3,401	2,678	9,971	4,059	3,196
<b>Total</b>	<b>32,109</b>	<b>32,109</b>	<b>32,109</b>	<b>32,109</b>	<b>32,109</b>	<b>32,109</b>
<b>Current Snowmobile Renters</b>						
Snowmobile in YNP with unguided rental	0	0	0	0	0	0
Snowmobile in GTNP/Parkway with unguided rental	12,078	12,078	12,078	0	0	0
Snowmobile in YNP with guided rental	43,266	41,927	40,588	0	0	0
Ride snowcoach in parks	4,382	4,382	4,382	20,214	27,326	38,246
Use unguided rental in GYA outside parks	4,382	6,572	8,763	9,793	14,492	19,059
Continue to visit parks for nonmotorized activities	6,433	5,581	4,729	15,487	11,880	8,086
Do not visit GYA	4,382	4,382	4,382	29,428	21,223	9,530
<b>Total</b>	<b>74,921</b>	<b>74,921</b>	<b>74,921</b>	<b>74,921</b>	<b>74,921</b>	<b>74,921</b>

<sup>a</sup>This does not imply that snowmobile owners do not visit the parks for nonmotorized activities but reflects an assumption that they will not substitute a nonmotorized visit to the park for a motorized visit.

**Table 3-9. Incremental Effects of the Delay Rule in 2003–2004**

	Scenario 1	Scenario 2	Scenario 3
<b>Current Snowmobile Owners</b>			
Snowmobile in YNP with personal machine on unguided trips	0	0	0
Snowmobile in GTNP/Parkway with personal machine	5,176	5,176	5,176
Snowmobile in YNP with guided rental	0	1,339	2,678
Ride snowcoach in parks	0	(799)	(1,598)
Use personal snowmobile in GYA outside parks	(3,561)	(5,059)	(5,739)
Continue to visit parks for nonmotorized activities <sup>a</sup>	0	0	0
Do not visit GYA	(1,615)	(657)	(518)
<b>Current Snowmobile Renters</b>			
Snowmobile in YNP with unguided rental	0	0	0
Snowmobile in GTNP/Parkway with unguided rental	12,078	12,078	12,078
Snowmobile in YNP with guided rental	43,266	41,927	40,588
Ride snowcoach in parks	(15,832)	(22,944)	(33,865)
Use unguided rental in GYA outside parks	(5,411)	(7,919)	(10,296)
Continue to visit parks for nonmotorized activities	(11,907)	(6,299)	(3,357)
Do not visit GYA	(25,046)	(16,842)	(5,148)

<sup>a</sup>This does not imply that snowmobile owners do not visit the parks for nonmotorized activities but reflects an assumption that they will not substitute a nonmotorized visit to the park for a motorized visit.

### 3.2.3 Benefits

#### **Benefits to Snowmobile Riders**

The January 2001 rule would have limited the number of snowmobiles allowed in the parks in 2002–2003 and banned them in 2003–2004. The delay rule postpones the implementation of these restrictions for 1 year. It allows snowmobiles to enter the parks without limits in the winter of 2002–2003 and sets limits for the numbers of snowmobiles that can enter the park in 2003–2004, as well as a requirement for guided tours. This section describes the consumer surplus benefits to snowmobile riders that will result from implementing the delay rule compared to the January 2001 rule.

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*Discussions with park staff and rental shop owners suggest that the majority of snowmobile riders who currently use the park would not consider the national forests a good substitute.*

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If snowmobile use in the three parks was restricted, riders who currently ride in the national parks for at least some portion of their trip to the area would experience a loss in consumer surplus. To the extent that individuals consider areas in nearby national forests close substitutes, the loss in consumer surplus associated with closing the parks would be lessened. Discussions with park staff and rental shop owners suggest that the majority of snowmobile riders who currently use the park would not consider the national forests a good substitute. Most riders in the park are interested in the chance to view unique natural features, such as the geysers, and more plentiful wildlife that are not duplicated in the surrounding forests. It is possible that some avid snowmobile riders prefer the longer, more challenging trails and varied terrain of the national forest. The 45-mph speed limit in the national parks may also be unattractive to some riders. These riders may continue to visit the GYA and suffer little loss in consumer surplus even if snowmobiles are banned in the three parks.

Similarly, the loss in consumer surplus would be mitigated to the extent that snowcoach tours of YNP offer an acceptable substitute for viewing the park. Business owners indicated that for some customers, the coach tours are a very poor substitute for riding a snowmobile in the park and that some customers would not visit the park if snowmobiles were banned. Other customers are less interested in riding snowmobiles and more interested in seeing the sights of YNP and would find snowcoaches an acceptable substitute.

For each individual, consumer surplus for the chosen activity includes the value for substitute activities. Thus the total change in consumer surplus would be the sum of the changes for each individual whose recreation choices were affected by the proposed alternative. Following the implementation of a cap on the number of snowmobiles permitted in the parks, snowmobile riders who are denied access to the parks because of the cap would lose consumer surplus. However, those riders and other visitors who do get into the park may experience an increase in consumer surplus because it would be less crowded and the potential problems of noise, air emissions and safety considerations associated with snowmobiles will be lessened. In addition, a requirement to be part of a guided tour to ride in YNP would also diminish the consumer surplus of



those riders who prefer to see the park at their own pace. On the other hand, the consumer surplus may be increased for people who get enhanced enjoyment from the interpretive services offered by the guides in what may be for novices the more secure environment that is provided by snowmobiling with an experienced guide. In the results below, NPS does not account for increases in consumer surplus to visitors who would have had a better park experience if snowmobiles were prohibited under a ban or restricted by limits on the number of snowmobiles allowed in the parks. From this perspective, the consumer surplus change measures overstate the total net benefit in consumer surplus from the delay rule.

If each individual's demand curve for riding in the national parks were known, then NPS could add up the change of consumer surplus for each individual to find the total change in consumer surplus to the snowmobile riders in the parks for a given change in visitation. Because the demand curve reflects the individual's preferences for available substitute activities, measuring the lost consumer surplus from a trip in the parks accounts for the level of consumer surplus experienced by the individual in their next best alternative. In this case, NPS does not know the consumer surplus associated with riding in the parks, nor are the riders' next best alternative activities known.

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*To assess the incremental change in consumer surplus for snowmobilers, NPS used the benefit transfer technique.*

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In this section, NPS provides a general sense of the possible monetary gains in consumer surplus to snowmobilers from the implementation of the delay rule. To assess the incremental change in consumer surplus for snowmobilers, NPS used the benefit transfer technique. The benefit transfer methodology has been accepted as an appropriate methodology for estimating natural resource values in other rulemakings (see FAA, 2000). Ideally, a benefit transfer function based on regression analysis of a large number of studies would be used to calibrate existing estimates of consumer surplus for a day of snowmobile riding to conditions in GYA. The benefit transfer function would allow adjustment of consumer surplus to the site quality and typical experience in the GYA compared to other nearby areas.

While using benefit transfer saves the time and money required to conduct a study specific to the GYA's needs, the ability to use benefit transfer is limited by the availability of appropriate studies. According to regulations for natural resource damage assessment

promulgated by the National Oceanic and Atmospheric Administration (NOAA) under the Oil Pollution Act of 1990, transferring values from one study to another is an acceptable methodology provided that the following three basic issues are considered (see Volume 61 of the *Federal Register*, p. 499, published on January 5, 1996):

- comparability of the users and resources/services being valued,
- comparability of the quantity or quality of the resources/services being valued, and
- quality of the selected study.

After conducting an extensive review of the economics literature and consulting with the authors of existing studies, experts in recreation demand analysis at universities and experts at other consulting firms, NPS located two studies that estimated the consumer surplus for a day of snowmobiling. Walsh et al. (1988) reviewed all types of outdoor recreation demand and found one study for snowmobiling by Keith et al. (1978) and Keith (1980). A later meta-analysis produced by Rosenberger and Loomis (2000) reports the value from one additional study by May et al. (1997) in which the values come from her Master's thesis. Coupal et al. (1999) is a related output of the May (1997) study. The other study, Keith et al. (1978) and Keith (1980), was conducted in the late 1970s, and NPS believes the more recent studies provide more suitable values.

To assess the change in consumer surplus for snowmobile riders currently riding in the three parks, NPS used estimates from Coupal et al. (1999). The study by Coupal et al. (1999) surveyed snowmobile owners from Wyoming about snowmobiling in Wyoming. Using the travel cost method, Coupal et al. (1999) estimated that the average consumer surplus value associated with the riders' self-defined favorite areas was \$68 per trip (in 1996 dollars, \$77 in 2001 dollars). The authors calculated average consumer surplus per day by dividing the \$68 consumer surplus per trip by the average length of a trip in their sample (1.57 days). Average consumer surplus per day was \$43 (in 1996 dollars, \$49 in

2001 dollars).<sup>14</sup> In May (1997), on which Coupal et al. (1999) is based, 1.4 percent of trips taken by respondents in their sample were to YNP, 0.6 percent to GTNP, 5.7 percent on the Continental Divide Trail. While most of the respondents did not provide values for snowmobiling in the GYA, respondents provided values for their favorite snowmobiling site, and YNP is likely the favorite site of a large percentage of park snowmobilers. Because NPS lacks data on the consumer surplus generated by snowmobiling in the GYA, \$49 is used as the average per day value in the benefit transfer. This value was chosen based on the following criteria:

- The activity valued in the Coupal et al. (1999) study is comparable to snowmobiling in the GYA.
- The data was collected in Wyoming, the state in which a large section of the study site is located.
- The values reported in Coupal et al. are based on 818 observations, with a response rate of 57 percent.

In 2002–2003, the delay rule would benefit snowmobilers in comparison with the terms of the January 2001 rule by allowing them continued access to the parks under the current management regime. Under the delay rule snowmobile riders would also benefit in 2003–2004 relative to the January 2001 rule because they would still have access, albeit restricted, to the parks. NPS calculated benefits to snowmobilers under the scenarios described above. The following sections present estimates of the benefits of the delay rule to snowmobilers for the 2002–2003 and 2003–2004 winters.

### ***Winter 2002–2003: Consumer Surplus Impacts to Snowmobilers of the Delay Rule Relative to the January 2001 Rule***

The gain in consumer surplus from implementing the delay rule ranges from approximately \$2,177,600 to \$3,525,100 for the 2002–2003 season, depending on the scenario and per-person surplus measure used by NPS.

The delay rule will allow snowmobile riders to continue to access the parks without limits during the winter of 2002–2003. The January 2001 rule would have set entry-specific limits on the number of snowmobiles allowed into the parks and required guided tours. The delay rule benefits those snowmobilers who would have been turned away under the January 2001 rule or required to take a guided tour or ride in a snowcoach. NPS' scenarios assume that most renters would switch to guided tours under the January 2001

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<sup>14</sup> It should be noted that the study breaks snowmobilers into five groups based on their primary reasons for snowmobiling and that the estimated surplus values for four of the five groups are lower than the average values for the pooled sample.

rule, while most owners would not be willing to switch to renting snowmobiles to go on guided tours. Because of this assumption, snowmobile owners suffer greater losses than snowmobile renters under the January 2001 rule in the winter of 2002–2003.

Table 3-10 provides a lower-bound estimate for the gain in consumer surplus for the 2002–2003 and 2003–2004 winter seasons that results from the implementation of the delay rule as opposed to the January 2001 rule. The consumer surplus values from Coupal et al. (1999) represent the average consumer surplus for a trip to YNP. The scenarios outlined in Section 3.2.2 estimate the number of individuals who would not make trips to YNP, GTNP, or the Parkway as a result of the January 2001 rule.<sup>15</sup> If one assumes that the enjoyment (or level of utility) for snowmobile riders who continued to visit YNP, GTNP, or the Parkway does not depend on the mode of transportation, then as a lower bound on gains in consumer surplus from implementing the delay rule, NPS calculated the gain in consumer surplus to individuals who would not have visited YNP, GTNP, or the Parkway under the January 2001 rule using the per-trip value of \$77. The gains in consumer surplus range from \$2,740,000 to \$2,768,500.

Of course, there are visitors who come specifically to ride a snowmobile in the parks, so the mode of transportation used in the park affects the value of their trip. Table 3-11 presents an alternative, larger estimate of the consumer surplus gains associated with the delay rule based on the assumption that visitors who were no longer willing or able to ride a snowmobile in the national parks would lose the full value of their consumer surplus.<sup>16</sup> The estimate based on the per-day willingness to pay, ranges from \$2,177,600 to \$2,243,300 (Table 3-11, Column 4). The per-trip willingness to pay

<sup>15</sup>This is the sum of the number of visitors who would not have visited the GYA or who would have recreated outside the parks under the January 2001 rule versus the delay rule. From Table 3-6 Scenario 1, the difference between the number of owners who would not have visited the GYA or would have recreated outside the GYA under the January 2001 rule and the delay rule was 27,086 (18,449 + 8,637). For renters in Scenario 1 the difference is 8,774 (4,387 + 4,387).

<sup>16</sup>Based on Table 3-6, the difference in the number of snowmobile owners who would not snowmobile in the three parks under the January 2001 rule versus the delay rule in 2002–2003 is 27,086 (18,449 + 8,637) in Scenario 1, plus the number who ride in a snowcoach in the other scenarios. The number of snowmobile renters who would not snowmobile in the parks under the January 2001 rule was 18,965 (4,387 + 4,387 + 5,804 + 4,387) under Scenario 1.

**Table 3-10. Lower Bound Estimates of Gain in Consumer Surplus for Snowmobile Riders in YNP, GTNP, and the Parkway**

	Total Affected Snowmobile Owners	Total Affected Snowmobile Renters	Consumer Surplus Gains
Winter 2002–2003			
Scenario 1	26,816	8,774	\$2,740,400
Scenario 2	24,805	10,967	\$2,754,400
Scenario 3	22,793	13,161	\$2,768,500
Winter 2003–2004			
Scenario 1	4,673	30,016	\$2,671,100
Scenario 2	5,238	24,381	\$2,280,700
Scenario 3	5,803	15,190	\$1,616,500

Note: Scenarios are defined in Section 3.2.2. Consumer surplus gain was estimated in 2001 dollars. Dollar values are rounded to the nearest \$100. A per-trip value of \$77 was used for the calculations.

**Table 3-11. Estimates of Gain in Consumer Surplus for Snowmobile Riders in YNP, GTNP, and the Parkway**

	Total Affected Snowmobile Owners	Total Affected Snowmobile Renters	Per-Day Consumer Surplus Gains	Per-Trip Consumer Surplus Gains
Winter 2002–2003				
Scenario 1	26,816	18,965	\$2,243,300	\$3,525,100
Scenario 2	24,805	20,306	\$2,210,400	\$3,473,500
Scenario 3	22,793	21,647	\$2,177,600	\$3,421,900
Winter 2003–2004				
Scenario 1	4,673	54,525	\$2,900,700	\$4,558,200
Scenario 2	6,037	53,161	\$2,900,700	\$4,558,200
Scenario 3	7,401	51,798	\$2,900,800	\$4,558,300

Note: Scenarios are defined in Section 3.2.2. Consumer surplus gain was estimated in 2001 dollars. Dollar values are rounded to the nearest \$100. Consumer surplus gains were calculated by summing the total number of snowmobile owners and multiplying by a per-day value of \$49 and a per-trip value of \$77.

ranges from \$3,421,900 to \$3,525,100 (Table 3-11, Column 5). The per-trip measure of consumer surplus will overstate actual consumer surplus if riders entered the parks more than one time on their trip because NPS has not adjusted the visitation figures to

account for the same visitor making multiple entries. The per-day consumer surplus value will understate the loss in consumer surplus for those individuals who cancel their entire trip (which may include activities outside the park) because they cannot visit the park using their preferred mode of transportation.

Here NPS assumes that the value of an unguided trip is equal to a guided trip, recognizing that this is not likely to be true for all riders and so the estimates do not capture the full value of consumer surplus changes. Some riders will prefer the guided trips, while some will prefer the unguided trips. To the extent that guided snowmobile trips are more expensive (currently guided trips out of West Yellowstone are approximately \$20 more than unguided trips), riders who are required to take guided tours will lose this amount in consumer surplus even assuming the guided and unguided trips provide the same level of utility.

### ***Winter 2003–2004: Consumer Surplus Impacts to Snowmobilers of the Delay Rule Relative to the January 2001 Rule***

The gain in consumer surplus from implementing the delay rule ranges from approximately \$1,616,500 to \$4,558,300 for the 2003–2004 season, depending on the scenario and per-person surplus measure used by NPS.

In the winter of 2003–2004, the delay rule specifies entry-specific limits on the number of snowmobiles allowed into the parks and the requirement for snowmobiles to be part of guided tours in YNP. Under the January 2001 rule, snowmobiles would be banned from all three parks. Again, the delay rule benefits snowmobilers by preserving the option for a limited number of visitors to enter the park by snowmobile. Under the delay rule, NPS assumes that the majority of snowmobile riders in the park, who are required to be on guided tours in YNP, are renters. Thus it is the snowmobile renters who gain the most under the delay rule in the winter of 2003–2004.

Table 3-10 also provides a lower-bound estimate for the gain in consumer surplus for the 2003–2004 winter season that results from implementing the delay rule as opposed to the January 2001 rule. The scenarios outlined in Section 3.2.2 estimate the number of individuals who would not make trips to YNP, GTNP, or the Parkway in the winter of 2003–2004 as a result of the January 2001

rule compared to the delay rule.<sup>17</sup> Using the per-trip measures of consumer surplus, the gains in consumer surplus to snowmobile riders from implementing the delay rule range from \$1,616,500 to \$2,671,100.

Table 3-11 presents the alternative, larger estimate of the consumer surplus gains associated with the delay rule based on the assumption that visitors who were no longer willing or able to ride a snowmobile in the national parks would lose the full value of their consumer surplus.<sup>18</sup> The change in welfare does not vary across scenarios in this case because it is assumed that, given excess demand, the full number of snowmobilers allowed under the cap would be met under each scenario and that only the allocation between owners and renters would change. The gain in consumer surplus using the per-day willingness to pay is approximately \$2,900,700 (Table 3-11, column 4). The consumer surplus gain using the per-trip willingness to pay is approximately \$4,558,200 (Table 3-11, column 5). In both columns the gain under Scenario 3 is \$100 more due to the rounding of total snowmobilers to the nearest whole number.

Riders who currently ride in nearby areas will also benefit from the delay rule. These riders will lose some consumer surplus if the trails become more crowded as the numbers of machines are restricted in the three parks. Although no studies were available that examined the impact of congestion on the value of a snowmobile trip, other recreation demand studies find that congestion lowers the value of a recreation experience (see Appendix A).

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<sup>17</sup>This is the difference between the number of visitors who would do not visit GYA or who would recreate outside the national parks under the January 2001 rule versus the delay rule. In Table 3-9, the number of additional owners who would make trips to the GYA and recreate inside the parks under the delay rule equals 4,673 (or 3,215 + 1,458) under Scenario 1. Likewise the additional renters who would visit the GYA and recreate in the national parks under the delay rule is 30,016 (or 24,685 + 5,331) under Scenario 1.

<sup>18</sup>This represents the difference between the number of visitors who would have used a snowmobile in the parks under the January 2001 rule versus under the delay rule. From Table 3-9, in Scenario 1 54,525 additional snowmobile riders would use the park under the delay rule (11,259 + 43,266) and 4,673 snowmobile owners would have ridden in the park under the January 2001 rule.

### **Uncertainty**

It is important to recognize the uncertainty surrounding these estimates. Some sources of uncertainty include the following:

- Visitors who are still allowed into the parks after snowmobiling restrictions are implemented may experience an increase in consumer surplus because of the restrictions on snowmobiles. The values of these increases are not included in NPS' analysis because of a lack of data on how much consumer surplus would increase for these visitors. Nevertheless, these potential increases in consumer surplus could be important, as they would cause NPS' projections of the baseline decrease in snowmobile-related consumer surplus, and as a result the of the delay rule to riders, to be overstated.
- The majority of the respondents providing values for the Coupal et al. (1999) study snowmobile in other areas of Wyoming. To the extent that these recreation sites differ from the GYA, the value that respondents placed on them may differ from the value that snowmobilers place on riding in the GYA.
- Coupal et al. (1999) surveyed Wyoming snowmobile owners using the travel cost method for sites within Wyoming. Non-residents and those who rent snowmobiles may differ from this group with respect to trip length and motivations and may therefore value snowmobiling in a different way.

### **Benefits to Businesses**

The delay rule will result in increased numbers of snowmobiles in YNP, GTNP, and the Parkway during the winters of 2002–2003 and 2003–2004. The increase will affect the suppliers of snowmobile and other tourism-related services in the GYA. Under the baseline January 2001 rule, current snowmobile riders could respond to the limits on entrance in the winter of 2002–2003 and the ban on snowmobiles in 2003–2004 in a variety of ways that imply different impacts on the local economy. It is possible, although unlikely, that all the people currently riding in the national parks may decide to ride in the surrounding national forests and demand for snowmobile services would remain unchanged. Other snowmobilers may decide to continue visiting the GYA but will engage in different activities. This would lead to a decrease in demand for snowmobile services (and a possible increase in demand for other services such as snowcoach tours) but no significant change in lodging, meals, or other tourism-related



expenditures. Finally, some riders may decide not to visit GYA, resulting in a loss of snowmobile and tourism-related expenditures in the area (although presumably these expenditures would still be made in another area of the country for snowmobiling or other activities).

To estimate the impact of delaying the baseline January 2001 rule for one year, NPS constructed a series of scenarios, described in detail in Section 3.2.2. Each scenario makes different assumptions about the new activities of the displaced snowmobile riders. Impacts on revenue from unguided snowmobile rentals, guided snowmobile rentals, and snowcoach trips were each estimated separately. The recreation-related businesses in the GYA offer a variety of services. Some shops offer only unguided snowmobile rentals, while others offer guided tours and/or snowcoach trips. It is likely that some businesses will lose revenue in one area and gain in another area.

NPS calculated changes in revenue under the January 2001 rule and under the delay rule for the winters of 2002–2003 and 2003–2004 for unguided snowmobile rentals, guided snowmobile rentals, snowcoach tours, hotels, restaurants, grocery stores, gas stations, and souvenir shops. To estimate these impacts, it is necessary to obtain spending information for use in conjunction with this study's estimates on changes in visitation. A weighted-average daily rate for unguided snowmobile rentals was generated using information provided by the local rental shops on their prices and the types of snowmobiles they rent (i.e., number of single passenger and double passenger machines). The average rental price per unguided snowmobile is estimated to be about \$114. The average price of a full-day snowcoach tour is estimated to be about \$90 per person based on information from local businesses. For guided snowmobile tours entering YNP through the west entrance, it was assumed that the price averages about \$20 more than for an unguided rental (about \$134) based on information from a local business providing these services.<sup>19</sup> Because the west entrance is where most of the visitors would be switching from unguided to guided rentals (most rentals entering through the south entrance are already guided), this was the price used for the analysis.

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<sup>19</sup>Figure on premium for guided rentals provided by business (Branton, 2001).

For the other categories of spending analyzed, data from a visitor survey conducted by Duffield and Neher (2000) of expenditures by residents and nonresidents were used. The data were modified to account for expenditures in the five-county GYA rather than the 17-county GYA by multiplying 17-county GYA expenditure data by 76.5 percent (Neher, 2001). In addition, the expenditure data provided from this source were for trips and were adjusted to daily expenditures by dividing trip expenditures by the average trip length of 3.6 days spent in the GYA. Daily expenditures per person for these other categories are provided in Table 3-12.

**Table 3-12. Estimated Spending Profiles for Visitors to National Parks in GYA (2001\$)**

	Daily Expenditures per Person	
	Resident	Nonresident
Lodging	\$21.37	\$58.86
Restaurants and bars	\$12.36	\$21.21
Groceries/take-out	\$4.12	\$9.25
Gas and oil	\$5.31	\$5.81
Souvenirs/retail	\$5.88	\$15.18
<b>Total</b>	<b>\$49.04</b>	<b>\$110.31</b>

The direct impact on GYA business revenues was estimated by multiplying the change in the number of visitors to the GYA by their spending in each category and by multiplying the estimated increase in the number of snowcoach tours and guided snowmobile tours by their respective prices to capture substitution towards these recreational options. These estimates were generated for each of the scenarios developed for 2002–2003 and 2003–2004. The reduction in the number of snowmobilers to the area will directly reduce the revenues of the snowmobile rental shops as well as the revenues of hotels, restaurants, and other stores patronized by snowmobilers. However, these reductions are partially offset by the increase in snowcoach revenues and revenue from guided snowmobile tours.

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*The direct impact on GYA business revenues was estimated by multiplying the change in the number of visitors to the GYA by their spending in each category and by multiplying the estimated increase in the number of snowcoach tours and guided snowmobile tours by their respective prices to capture substitution towards these recreational options.*

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Using these revenue calculations, NPS estimated the difference in revenue to different types of businesses in each year between the baseline and delay rules. To translate lost revenue into lost producer surplus, the estimates of the change in revenue from implementing the delay rule was multiplied by the profit margins for the Standard Industrial Classification (SIC) code provided by Dun & Bradstreet for each type of business.<sup>20</sup> The use of profit margins, net profit after tax divided by sales, should approximate changes in producer surplus; however, the two measures are not the same. Producer surplus captures the difference between variable costs and revenue, while profit will contain some measure of fixed cost. For this reason, the profit measure may understate producer surplus changes.

**Winter 2002–2003: Producer Surplus Impacts of the Delay Rule Relative to the January 2001 Rule**

Table 3-13 presents the estimated change in producer surplus in the winter of 2002–2003 from implementing the delay rule compared to the baseline January 2001 rule. NPS estimated changes for the three scenarios described in Section 3.2.2. The high and low estimates correspond to the high and low profit margins for businesses in that SIC code. Under the January 2001 rule, there would be limits on the number of snowmobiles allowed into the parks and all the snowmobiles in YNP would be part of guided tours. Thus the delay rule is predicted to result in higher revenues for unguided snowmobile rentals, while revenues from guided snowmobile rentals and snowcoach tours are lower than they would have been under the baseline January 2001 rule. Hotels, restaurants, grocery stores, gas stations, and souvenir shops are predicted to benefit from the higher levels of visitation to the GYA under the delay rule in 2002–2003.

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<sup>20</sup>The profit ratios, net profit after tax divided by sales, come from Dun & Bradstreet for SIC 7999 for 1997. The upper quartile profit ratio is 14.2 percent and the lowest quartile is 0.5 percent.

**Table 3-13. Estimates of Change in Producer Surplus from Delay Rule, Winter 2002–2003 (2001\$)<sup>a</sup>**

	Scenario 1		Scenario 2		Scenario 3	
	Low	High	Low	High	Low	High
Snowmobile unguided rentals	\$17,910	\$508,510	\$16,910	\$480,260	\$15,290	\$452,010
Snowmobile guided rentals	\$(11,510)	\$(326,840)	–\$11,510	–\$326,840	–\$11,510	–\$326,840
Snowcoaches	\$(1,940)	\$(55,060)	–\$2,240	\$63,470	– \$2,530	–\$71,890
Hotels	\$5,580	\$63,080	\$4,230	\$47,780	\$4,030	\$45,550
Restaurants	\$1,160	\$14,470	\$800	\$9,950	\$740	\$9,300
Grocery stores	\$290	\$2,210	\$210	\$1,610	\$200	\$1,520
Gas and oil	\$30	\$2,130	\$20	\$1,330	\$20	\$1,210
Souvenir shops	\$1,250	\$11,260	\$940	\$8,420	\$890	\$8,010

Note: Rounded to the nearest \$10.

<sup>a</sup>The low and high estimates are calculated using estimates of the average profit ratio for firms in the lower and upper quartile of firms in their SIC code, respectively.

### ***Winter 2003–2004: Producer Surplus Impacts of the Delay Rule Relative to the January 2001 Rule***

Table 3-14 presents the estimated change in producer surplus in the winter of 2003–2004 from implementing the delay rule. Under the baseline January 2001 rule, snowmobiles would be banned in all three parks. The delay rule, which stipulates limits on entry to the parks and guided tours in YNP, will benefit guided snowmobile rentals. The impact on revenue from unguided snowmobile rentals varies by scenario. In Scenarios 2 and 3, the baseline January 2001 rule calls for a ban on snowmobile use in the three national parks, and NPS assumed that some fraction of the people who used to ride in the parks would still rent snowmobiles for unguided riding outside the parks in the national forests. Under the delay rule, some of these people would be able to take guided snowmobile tours of Yellowstone. This accounts for the loss in revenue to unguided snowmobile rentals. Snowcoach businesses will also lose revenue in 2003–2004 compared to expected revenue under the ban on snowmobiles. Again, the other businesses listed in Table 3–14 will benefit from the higher levels of visitation to the area expected under the delay rule in 2003–2004.

**Table 3-14. Estimates of Change in Producer Surplus from Delay Rule: Winter 2003–2004 (2001\$)<sup>a</sup>**

	Scenario 1		Scenario 2		Scenario 3	
	Low	High	Low	High	Low	High
Snowmobile unguided rentals	\$4,690	\$133,230	\$1,070	\$30,520	–\$2,440	–\$69,310
Snowmobile guided rentals	\$19,990	\$567,830	\$19,990	\$567,830	\$19,990	\$567,830
Snowcoaches	–\$7,160	–\$203,270	–\$10,720	–\$304,520	–\$16,000	–\$454,430
Hotels	\$5,580	\$63,080	\$4,230	\$47,780	\$4,030	\$45,550
Restaurants	\$3,330	\$41,590	\$2,210	\$27,580	\$710	\$8,830
Grocery stores	\$960	\$7,180	\$640	\$4,780	\$200	\$1,520
Gas and oil	\$80	\$4,810	\$50	\$3,160	\$20	\$1,030
Souvenir shops	\$4,310	\$38,780	\$2,870	\$25,840	\$910	\$8,180

Note: Rounded to the nearest \$10.

<sup>a</sup>The low and high estimates are calculated using estimates of the average profit ratio for firms in the lower and upper quartile of firms in their SIC code, respectively.

The ranges of effects on producer surplus in Tables 3-13 and 3-14 represent estimates based on a number of assumptions about changes in visitation.

### **Uncertainty**

As with the consumer surplus estimates provided above, it is important to recognize several sources of uncertainty surrounding these estimates, including:

- Increases in visitation by nonsnowmobilers such as sightseers, skiers, or snowshoers may mitigate the decline in visitation by snowmobilers. However, these potential increases were not included in the analysis due to insufficient data.
- For all of the scenarios considered, it was necessary to make a number of assumptions about changes in winter use patterns (e.g., the number of people renting unguided snowmobiles that would switch to guided snowmobile tours, snowcoaches, etc.). To the extent that these assumptions overstate or understate the change in a particular activity, the impacts on businesses deriving revenue from that activity may be overestimated or underestimated.
- The expenditure patterns of the visitors in the GYA are based on averages from visitor surveys conducted in the

parks. To the extent that the expenditure patterns of the visitors affected by the snowmobile restrictions differ from the average values, impacts to local businesses may differ from those estimated.

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*The delay rule provides the businesses in the GYA with the revenue from an additional year of unrestricted snowmobile use in the parks, but it does not resolve the uncertainty over the rule that will be implemented for the 2003–2004 season and beyond.*

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### **The Impact of Regulatory Uncertainty on Businesses**

Regulatory uncertainty over the fate of snowmobiles in YNP, GTNP, and the Parkway remains high. In general, uncertainty affects the ability or willingness of businesses to plan and make investments for the future. If the January 2001 rule were going to be implemented with certainty, delaying implementation of the January 2001 rule provides businesses an additional year to adjust to the coming restrictions on snowmobiles and the ultimate ban of snowmobiles from the parks. However, the purpose of the delay rule is to allow NPS additional time to consider alternative regulations. The delay rule provides the businesses in the GYA with the revenue from an additional year of unrestricted snowmobile use in the parks, but it does not resolve the uncertainty over the rule that will be implemented for the 2003–2004 season and beyond.

Delaying the implementation of the January 2001 rule may possibly adversely impact those businesses that invested in snowcoaches or made other decisions based on the assumption that the baseline rule would be implemented as published.

### **Impact through National Park Expenditures in YNP, GTNP, or the Parkway**

Snowmobile riders pay \$15 for a 7-day pass to enter the parks. Revenue from entrance fees would have declined under the baseline January 2001 rule beginning in the winter of 2002–2003 if visitation to the parks had declined and the decreases were not offset by increases in visitation by snowcoaches or skiers. Under the delay rule, if visitation is higher in the winters of 2002–2003 and 2003–2004 than it would have been under the baseline January 2001 rule revenue from entrance fees will be higher. As the regulations are phased in, a decline in entrance fee revenue may have welfare impacts on local businesses, local residents, and visitors. To the extent that local workers or businesses are hired by YNP, GTNP, or the Parkway to work in the park, there may be losses in producer surplus if the parks spend less money in the

surrounding communities. Park visitors' welfare may be affected to the extent that there is less revenue for maintenance and improvements in the park (net any decreases in expenditures that were formerly needed for snowmobiles).

### ***Impact through the Town of West Yellowstone***

West Yellowstone, Montana, applies a 3 percent resort tax to lodging, dining, bars, snowmobile rentals, and souvenir sales (Neher, Robison, and Duffield, 1997). A decline in visitors to West Yellowstone as a result of the new regulation would also affect the tax revenue and public services provided by the town to citizens and visitors. The welfare of businesses and individuals may be affected to the extent that fewer services are provided as a result of a decline in tax revenue, most of which is paid by visitors from outside the community. For example, several local officials and businessmen mentioned the importance of the resort tax for funding the local schools. In addition, if there are reductions in employment following the imposition of new regulations, then the loss of residents in West Yellowstone may also affect the viability of the school and other public services.

#### **3.2.4 Costs**

As described in Sections 2.7 and 3.1 and Appendix A, snowmobile use in national parks can be linked to a variety of negative impacts. Under the delay rule, snowmobile use would be higher in 2002–2003 and 2003–2004 than under the baseline January 2001 rule. Section 2.7 specifically describes the impacts on natural resources that are most likely to result from snowmobile use within the boundaries of YNP, GTNP, and the Parkway. This section assesses the costs of the delay rule resulting from the negative impacts of snowmobile use.

Currently, snowmobiling in YNP is permitted during the winter months on a large majority of the paved roadways within the park. Roughly 185 miles (out of a total of almost 300 roadway miles) are specifically groomed for snowmobile and snowcoach use, and they provide access to virtually all of the most popular sites and destinations within the park, such as the Geyser Basin, Old Faithful, and Hayden Valley. Most snowmobile activity takes place in the western portion of the park, which is most directly accessible from

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*Nonsnowmobiling winter recreators in YNP and GTNP whose park experience is negatively affected by the presence of snowmobiles bear the bulk of the costs from the delay rule.*

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the west entrance at the town of West Yellowstone. In GTNP and the Parkway, snowmobiles and snowcoaches are permitted on roughly 36 miles of groomed trails and snowmobiles alone are permitted on an additional 36 miles of ungroomed trails. The most commonly used route is between Flagg Ranch and the southern entrance of YNP.

Nonsnowmobiling winter recreators in YNP and GTNP whose park experience is negatively affected by the presence of snowmobiles bear the bulk of the costs from the delay rule. Among the more popular activities and means of experiencing the parks during the winter season other than snowmobiling are cross-country skiing, snowshoeing, winter hiking, automobile touring, and snowcoach touring. As shown in Table 2-3, in 2000–2001 the number of winter recreation visits to the park was roughly 138,800 to YNP, and nonsnowmobile visitors accounted for almost 40 percent of these visits.

Among nonmotorized winter recreators, cross-country skiers are those most likely to incur costs as a result of the delay rule. Based on estimates from the winter of 2000–2001, there were roughly 13,000 cross-country ski visits to YNP and almost 6,800 visits to GTNP, and the Parkway.<sup>21</sup> According to the estimates summarized in Table 3-2, the average value of cross-country ski outings in the Mountain region of the U.S. is about \$25 to \$30 per person-day.<sup>22</sup> This implies that the total potential value of these visits is \$500,000 or more per year. Negative externalities associated with snowmobiles may reduce the value of trips to YNP, GTNP, and the Parkway, causing a loss of consumer surplus for skiers. For reasons discussed in more detail below, the delay rule will result in losses for cross-country skiers during the winter seasons of 2002–2003 and 2003–2004. In addition, the delay rule may discourage additional ski visits to the parks and result in additional costs to these potential visitors in the process. Among other winter recreators, there were almost 11,700 snowcoach visitors in YNP in

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<sup>21</sup>The estimate for YNP was approximated using 2000–2001 winter visitation statistics for YNP and visitor surveys (Littlejohn, 1996; Borrie et al., 1999), which imply approximately 10 percent of visitors cross country skied at some point in their trip. The estimates for GTNP and the Parkway were taken directly from Table 2-8.

<sup>22</sup>These may well be underestimates, given the unique nature and experience provided by parks such as YNP and GTNP. These estimates are also presumably based on conditions without the presence of snowmobiles.



2000–2001. Because these recreators share many of the same routes through the park with snowmobilers, they are also directly affected and likely to be negatively impacted by the snowmobiles allowed into the park under the delay rule. Even snowmobile riders themselves may experience welfare gains from restrictions on snowmobiles riding due if the restrictions reduce the noise and other disamenities associated with current snowmobile technology.

Costs to “nonusers” of the park are also likely result from the proposed delay rule (see Section 3.1 and Appendix A for more details). For example, individuals who do not visit the parks can benefit simply from the knowledge that the natural resources of the park are being protected. Part of this benefit may stem from an increased assurance that the quality of the parks’ resources is being protected for the enjoyment future generations. Under the delay rule, nonusers will be less confident that the park is being protected and will therefore incur costs arising from the disutility of knowing that resources in the park may be compromised by the presence of snowmobiles. Therefore, some of the cost categories described below, in particular those associated with the preservation of unique park resources and ecosystems, may accrue in the form of nonuse values.<sup>23</sup>

### ***Aesthetic Costs***

Noise emissions have been identified as a particular nuisance to nonmotorized recreators, such as cross-country skiers and snowshoers, who tend to place a particularly high value on the tranquility and natural soundscape offered by the parks. Even though the park has several backcountry areas where these visitors can recreate without being disturbed by snowmobiles, under current conditions, it is virtually impossible for them to do so in the vicinity of the parks’ main attractions. Park officials indicate that snowcoach users are also frequently disturbed by snowmobile

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<sup>23</sup>The importance of recognizing these values is affirmed in the Organic Act. It established the fundamental purpose of the national park system, which includes providing for the enjoyment of park resources and values by the people of the United States. The mandate applies not just to the people who visit parks—but to all people—including those who derive inspiration and knowledge from afar. Furthermore, through the Redwood Act of March 27, 1978 Congress has provided that when there is a conflict between conserving national park resources and values and providing for enjoyment of them, conservation is to be the primary concern.

noise, especially during stops to view wildlife and enjoy the landscape. In contrast to skiing or snowshoeing, it is nearly impossible for snowcoach users to avoid contact with snowmobilers because they use the same routes. Therefore, reducing noise from snowmobile activity in the parks will benefit both motorized and nonmotorized recreators.

In addition to generating high noise levels, conventional snowmobiles also emit strong smelling fumes and visually perceptible emissions plumes that can be bothersome to other recreators. These effects tend to be much more localized than noise emissions. Whereas snowmobile noise can often be heard at distances of up to 2 miles, odors and visible plumes from snowmobiles tend to accumulate mostly within snowmobile corridors during periods of high use and when wind speeds are relatively low. Reducing these effects therefore primarily benefits visitors who come into relatively close contact with snowmobilers in the parks, such as snowcoach visitors who use the same routes and some skiers and snowshoers using trails that follow or traverse these routes.

The delay rule postpones the restrictions on snowmobile use that would have reduced noise levels and increased air quality and visibility in the parks, particularly in the vicinity of the current snowmobile routes. The baseline January 2001 rule would have improved the level of natural quiet throughout large portions of the parks, reduced unpleasant odors associated with exhaust fumes, and reduced the visible emissions from snowmobiles along the route network.

### ***Winter 2002–2003: Aesthetic Impacts of the Delay Rule Relative to the January 2001 Rule***

By reducing noise levels, the January 2001 rule would have provided additional recreation benefits to nonsnowmobiling recreators in the parks, such as cross-country skiers, snowshoers, and snowcoach riders. Under the delay rule, snowmobiles will still be allowed in the parks without limits during the winter of 2002–2003. A recent audibility analysis along nearly 350 miles of roadway in the three parks determined that vehicles (oversnow and wheeled) are audible in about 200,676 acres of the park and are

audible at least 50 percent of the time over 26,525 acres.<sup>24</sup> The most affected areas are along the heavily visited corridor between the west entrance and Old Faithful. Under the January 2001 rule, noise levels would have been reduced by capping snowmobile use. With as many as 26,000 fewer snowmobile visits per year, the natural quiet of the park would have been enhanced under this alternative. In addition, those snowmobilers still allowed in the park under the baseline January 2001 rule during the winter of 2002–2003 would have benefited from decreased odors and visible plumes. Under the delay rule, none of these benefits will be realized by any of the affected parties. Instead, snowmobile use will continue at existing levels and as a result, users of the park, both snowmobilers and nonsnowmobilers, will bear the aesthetic costs.

***Winter 2003–2004: Aesthetic Impacts of the Delay Rule Relative to the January 2001 Rule***

Under the delay rule, snowmobile use will be capped with entrance-specific limits on snowmobile entry as described in Section 1 during the winter of 2003–2004. The January 2001 rule would have banned snowmobile use in the parks during the winter of 2003–2004. Consequently, the delay rule imposes costs on visitors to the parks by compromising its aesthetic qualities.

If snowmobiles were banned, snowcoaches would continue to operate on the current snowmobile routes. These vehicles also generate noise but usually at a lower level and pitch than most snowmobiles.<sup>25</sup> More importantly, fewer of them are needed on a per-visitor basis. As a result, NPS estimates that, even if total visitation at the parks were to remain constant, the number of affected acres with any audible noise 10 percent of the time or more would drop by 11 percent relative to current conditions if snowmobile traffic were replaced by snowcoaches (NPS, 2000c; 2002). The number of acres with more than 50 percent noise would decrease by almost 47 percent from baseline levels to 47,087 acres (NPS, 2000c; 2002).

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<sup>24</sup>This is with average background conditions and excludes routes where automobiles are permitted during the winter.

<sup>25</sup>According to the NPS (2002) snowmobiles emit roughly 73 dBA at 50 feet (at an average speed of 40 mph; whereas conversion van coaches emit 70 dBA at 30 mph. Bombardier coaches, which are less common, emit 75 dBA at 30 mph.

Under the January 2001 rule, these noise reductions would have occurred during the winter of 2003–2004. However, under the delay rule, snowmobiles will not be banned from the parks but their numbers instead will be limited. The scenarios described in Section 3.2.2 predict that there may be up to 60,000 snowmobiles in the park under the delay rule, although the caps at entrances will limit the number of snowmobiles in the park on any one day. As a result, recreationists in the parks will be forced to endure the costs of delaying the aesthetic improvements that would have occurred under the January 2001 rule.

### **Human Health Costs**

Emissions from conventional carbureted two-stroke engine snowmobiles contain relatively high levels of pollutants such as CO, PM, and HCs, which are potentially damaging to human health. The highest potential threats to human health from these emissions occur during peak visitation periods, such as the mid-morning hours Christmas week and on Presidents' Day weekend, particularly in high use areas such as the west entrance. Ambient concentrations of CO and PM at the west entrance station kiosk have been measured at levels that may exceed federal ambient air quality standards (NPS, 2000a); however, these exceedances are usually very localized and of short duration.<sup>26</sup> Also, although it is not known which pollutants are directly responsible, NPS has received written complaints from several workers at this entrance indicating that they are much more likely to experience adverse acute symptoms such as nausea, headaches, and eye and throat irritation during peak visitation periods. Health-related costs from snowmobile use are therefore expected to accrue primarily to individuals who spend extensive periods in these high use areas, such as park workers managing the entrance gates. The delay rule will impose costs on all those who are currently affected by snowmobile emissions by delaying the benefits they would have received under the January 2001 rule.

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<sup>26</sup>These measurements do not necessarily constitute *violations* of the federal standards, due to sampling procedures and differences in averaging times.

**Winter 2002–2003: Human Health Impacts of the Delay Rule Relative to the January 2001 Rule**

Under the January 2001 rule, snowmobile use would have been capped in the parks during the winter of 2002–2003. This would have reduced the human health impacts of snowmobiles. However, the reduction in vehicles entering the park may not have eliminated health problems resulting from their emissions. Under the delay rule, there will be no change in the number of snowmobiles allowed in the park during the winter of 2002–2003. As a result, under the delay rule, people in areas of high snowmobile use will continue to experience costs related to health effects from snowmobile emissions during the winter of 2002–2003.

**Winter 2003–2004: Human Health Impacts of the Delay Rule Relative to the January 2001 Rule**

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*The delay rule imposes health costs by allowing snowmobile use to continue in the parks during the winters of 2002–2003 and 2003–2004.*

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The January 2001 rule would have banned snowmobiles in the parks during the winter of 2003–2004. Many visitors who entered on snowmobiles would have switched to snowcoaches. Switching to snowcoaches would have resulted in many fewer vehicles in the parks and concentrated at the park entrances, and each snowcoach produces fewer emissions than a single snowmobile with a two-stroke engine. Consequently, the delay rule imposes health costs by allowing snowmobile use to continue in the parks during the winter of 2003–2004. These impacts will be mitigated by the caps imposed on the numbers of vehicles allowed to enter the park.

**Ecosystem Protection Costs**

As described in Sections 2.7 and 3.1 and Appendix A, snowmobiling has the potential to negatively affect ecosystems and natural habitats in a variety of ways. In the case of national parks, these natural resources are of particular value to the public. Although current levels of snowmobile use in YNP, GTNP, and the Parkway do not appear to cause widespread ecosystem damages, snowmobiles in the parks can nonetheless result in costs to both visitors and to nonusers by negatively affecting the health some of the parks' natural resources.

As discussed in Section 2, wildlife may be adversely affected by the presence of snowmobiles in the parks. In addition to being a

potential nuisance to other recreators, noise from snowmobiles may disturb wildlife located in the vicinity of snowmobile routes. Such disturbances are of particular concern during winter months when animals are already stressed by climate and food shortages. Ungulate species, such as elk and bison, are of primary concern, because of their numbers and frequent proximity to snowmobile routes. This proximity often leads to harassment of wildlife along the groomed roads, due to the numbers and occasional inappropriate behavior of snowmobilers. In some instances, the physical safety of the animals is threatened by the presence of motorized oversnow vehicles. For example, between 1988 and 1998, 14 ungulates were killed by snowmobiles in YNP (NPS, 2000c). In general, however, risks of collisions between ungulates and snowmobiles are considered to be negligible. In addition, the net effects of groomed surfaces on ungulates is currently undetermined. Trumpeter swans that winter near these routes may also experience minor impacts when they are in the vicinity of snowmobile traffic. In addition four federally protected species—the Canada lynx, bald eagle, grizzly bear, and gray wolf—are present in the park and may be affected by snowmobile activity. The primary potential impact of concern relates to avoidance of habitat associated with oversnow vehicles and other backcountry visitors, however this impact is expected, for the most part, to be negligible.

Reducing potential harm to the parks' ecosystems would benefit park visitors, for example by improving their chances of viewing wildlife in a less stressful environment. It would also provide benefits to individuals across the country who value the parks' unique ecosystems and natural habitats, regardless of whether they actually visit the parks. That is, protecting the parks' ecosystems can provide extensive nonuse benefits to society. The delay rule prevents these potential benefits from being realized by postponing the positive effects that the January 2001 rule would have had on the ecosystem.

### ***Winter 2002–2003: Ecosystem Protection Impacts of the Delay Rule Relative to the January 2001 Rule***

Under the January 2001 rule, the number of snowmobiles entering the parks would have been reduced. In addition, the required use

of a guide accompanying all groups in YNP would have been implemented. Under the delay rule, these restrictions on snowmobile use will not be implemented during the 2002–2003 winter season and consequently, the ecosystem will continue to be affected in a manner consistent with the baseline levels described above (and in more detail in Section 2.7.6).

### ***Winter 2003–2004: Ecosystem Protection Impacts of the Delay Rule Relative to the January 2001 Rule***

The delay rule will postpone the ecosystem protection benefits that would have occurred during the 2003–2004 winter season under the January 2001 rule. Under the January 2001 rule, snowmobiles would have been banned in the parks and visitation would have shifted to snowcoaches during the 2003–2004 winter season. By significantly reducing the number of vehicles in the parks and by placing the driving responsibility in the hands of professional snowcoach drivers who are more experienced and accountable, this rule would have had a more protective effect on the parks' ecosystems. Instead, under the delay rule snowmobiles will still be allowed in the park. Any negative impacts on the parks' ecosystem will be mitigated by the reduction in the number of vehicles allowed in the parks, and the mandate that all snowmobilers in YNP be accompanied by a guide.

### ***Other Costs***

Other potential costs from delaying the restriction of snowmobile activity in the park include those associated with increases in the risks of snowmobile-related safety hazards and continued impairments in the quality of the groomed surface for oversnow vehicles. By reducing the number of vehicles in the park, snowmobile restrictions would improve the quality of the groomed surface of the oversnow routes in the parks. Under heavy traffic conditions (particularly from the west entrance to Old Faithful), the groomed surface can become very rough and unpleasant for snowcoach riders and snowmobilers.

To the extent that snowmobile riders are unaware of the risks that they face on the park roads, restrictions on snowmobile use would

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*The delay rule imposes costs on the park by requiring it to continue to devote resources towards the management of snowmobiles in the park that could have been diverted to other uses under the January 2001 rule.*

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benefit these individuals by protecting their safety.<sup>27</sup> Restrictions would also benefit nonsnowmobiling recreators by reducing their risks of being involved in accidents with snowmobiles. Reducing snowmobile-related accidents would also reduce the costs to NPS associated with medical/rescue operations, which would allow these resources to be redirected to other park management activities. The delay rule imposes costs on the above mentioned parties by postponing the accrual of these benefits.

In general, reducing snowmobile activity in the park would allow NPS to redirect resources that are currently devoted to snowmobile-related activities to other park management activities. As part of their regular activities, park rangers currently provide a range of services to snowmobilers including grooming roads and providing fuel, equipment repairs, minor first aid, directions, and emergency medical services. Incidents in the park that involve either general ranger support or law enforcement incidents involve a disproportionate number of snowmobiles relative to total winter visitors. The January 2001 rule would have reduced these demands on park resources. Consequently the delay rule imposes costs on the park by requiring it to continue to devote resources towards the management of snowmobiles in the park that could have been diverted to other uses under the January 2001 rule.

### **Winter 2002–2003: Ecosystem Protection Impacts of the Delay Rule Relative to the January 2001 Rule**

Under the January 2001 rule, snowmobile traffic would have been reduced in the parks during the winter season of 2002–2003. Snowcoach riders and the remaining snowmobilers would have benefited from better road conditions. In addition, requiring snowmobilers to be accompanied by guides in YNP would have reduced the safety hazards associated with snowmobiling, both for the snowmobilers themselves and other recreationists in the parks. The January 2001 rule would have also reduced the level of park resources required for managing snowmobile activity. As a result, the delay rule imposes costs on snowmobilers, snowcoach riders, and the park itself by eliminating the above described benefits that

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<sup>27</sup>If snowmobile riders are fully aware of the risks, NPS assumes that these effects are already discounted from the per-trip consumer surplus estimates for snowmobile riders.



would have occurred during the 2002–2003 winter season as a result of the implementation of the January 2001 rule.

### **Winter 2003–2004: Ecosystem Protection Impacts of the Delay Rule Relative to the January 2001 Rule**

Under the delay rule, snowmobiles will still be allowed in the park during the 2003–2004 winter season, although their numbers will be restricted. Snowmobiles would have been banned from the park under the January 2001 rule. The delay rule therefore imposes costs by increasing the amount of resources required for managing snowmobile activity, reducing the quality of the groomed surface for oversnow vehicles, and increasing the safety hazards from snowmobile-related incidents relative to the January 2001 rule.

### **Monetary Costs to Non-snowmobilers**

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*To assess the incremental change in consumer surplus for non-snowmobilers, NPS used the benefit transfer technique.*

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The negative aesthetic, human health and ecosystem impacts associated with snowmobile use in the GYA are borne largely by other winter visitors such as automobile and snowcoach passengers and cross-country skiers. Implementation of the delay rule would impose costs on these visitors by postponing the benefits that they would receive from a stricter snowmobile management regime. To assess the incremental change in consumer surplus for non-snowmobilers, NPS again used the benefit transfer technique. A review of the recreation literature conducted by Rosenberger and Loomis (2000) found average per person per day consumer surplus values of \$36.31 for sightseeing and \$11.71 for cross-country skiing (1996 dollars) in the Rocky Mountain Census Region.<sup>28</sup> Converted to 2001 dollars, these values are \$40.98 and \$13.22, respectively. Since no study could be found on consumer surplus associated with snowcoach riding, NPS grouped snowcoach passengers with automobile visitors and considered that the value for sightseeing is a reasonable proxy for these activities. Using the data on visitation shares for participants in various winter activities in YNP presented in Section 2, NPS constructed a weighted average of \$35.26 per person per day for winter activities other than snowmobiling. Visitation shares from the 200–2001 winter were used. For the

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<sup>28</sup> Rosenberger and Loomis (2000) found seven studies on sightseeing and one study on cross-country skiing in the region.

benefit transfer, NPS used the value from Rosenberger and Loomis (2000) based on the following criteria:

- Sightseeing and cross-country skiing are representative of the activities generally sought by nonsnowmobiling winter visitors to the GYA.
- The region where the data was collected includes Montana, Idaho and Wyoming, where the study site is located.
- Rosenberger and Loomis (2000) was published in a peer-reviewed journal. The authors consider 682 studies in their meta-analysis.

Using the value of \$35.26 per person per day, NPS provides a rough estimate of possible incremental losses in consumer surplus to non-snowmobilers as a result of the delay rule. In the following sections NPS estimates the consumer surplus losses for snowcoach and automobile visitors and non-motorized recreators for the 2002–2003 and 2003–2004 winters.

### ***Consumer Surplus Impacts to Non-snowmobilers of the Delay Rule Relative to the January 2001 Rule for the 2002–2003 and 2003–2004 Winter Seasons***

The expected loss in consumer surplus to non-snowmobilers from implementing the delay rule is approximately \$439,000 for the 2002–2003 season and approximately \$911,200 for the 2003–2004 winter season.

The delay rule will allow snowmobile riders to continue to access the parks without limits during the winters of 2002–2003 and 2003–2004. The January 2001 rule would have set entry-specific limits on the number of snowmobiles allowed into the parks and required guided tours during the 2002–2003 season and banned snowmobiles beginning in the 2003–2004 season. The delay rule imposes costs on GYA visitors who would have placed a higher value on trips made during this season with less snowmobile interference. Nonsnowmobiling visitation is held constant across NPS' scenarios because snowmobilers who switch to other forms of recreation in the parks are not considered.

Table 3-15 provides a lower-bound estimate for the loss in consumer surplus for the 2002–2003 and 2003–2004 winter seasons that results from the implementation of the delay rule as opposed to the January 2001 rule. The consumer surplus values from Rosenberger and Loomis (2000) represent the average non-snowmobiler consumer surplus for a trip to YNP. Visitation projections for YNP and GTNP were made using the growth rates specified in Tables 2-9 and 2-10.

**Table 3-15. Estimates of Welfare Loss for Other Winter Recreators in YNP and GTNP**

	YNP Visitors	GTNP Visitors	Consumer Surplus Change
Winter 2002–2003			
Scenario 1	56,337	192,842	–\$439,300
Scenario 2	56,337	192,842	–\$439,300
Scenario 3	56,337	192,842	–\$439,300
Winter 2003–2004			
Scenario 1	57,295	201,126	–\$911,200
Scenario 2	57,295	201,126	–\$911,200
Scenario 3	57,295	201,126	–\$911,200

Note: Growth rates for visitation projections are supplied in Tables 2-9 and 2-10. Consumer surplus loss was estimated in 2001 dollars. Dollar values are rounded to the nearest \$100. The welfare changes were calculated using a per-day value of \$35.26 for trips by non-snowmobilers and assuming a 5 percent decline in consumer surplus in 2002–2003 and a 10 percent decline in 2003–2004.

For the 2002–2003 season, NPS estimates that visitation to the GYA by non-snowmobilers will not change but that this group will lose 5 percent of its consumer surplus due to the delay rule. This is based on the fact that there will be no restrictions on snowmobile numbers, whereas under the January 2001 rule a cap would have been established. Using the per-day value for consumer surplus, NPS projects that the total consumer surplus loss will be approximately \$439,000.

For the 2003–2004 season, NPS estimates that visitation to the GYA by non-snowmobilers will not change but that this group will lose 5 percent of its consumer surplus due to the delay rule. This is based on the fact that the number of snowmobilers entering the parks will be capped, whereas snowmobiles would have been banned under the January 2001 rule. Using the per-day value for consumer surplus, NPS projects that the total consumer surplus loss will be approximately \$911,200.

This measure of welfare change will understate actual consumer surplus loss if non-snowmobilers visit the parks for more than one day or make more than one trip in a season. The per-day consumer

surplus value will also understate the loss in consumer surplus for those individuals who cancel their entire trip (which may include activities outside the park) because of the continued unlimited snowmobile access.

### **Uncertainty**

Some sources of uncertainty surrounding NPS' estimates of lost consumer surplus due to the delay rule include the following:

- NPS' projections for changes in consumer surplus among non-snowmobilers are based on the expected change in visitation patterns for current visitors. They fail to consider individuals who do not currently visit the parks in the winter but who may decide to do so under a stricter snowmobile management regime due to a lack of data on the extent to which this would occur. As a result, consumer surplus losses attributable to the delay rule could be understated.
- The results reported in Rosenberger and Loomis (2000) are based on studies carried out in various parts of the Rocky Mountain Census Region and do not necessarily value the types of natural features and tourist infrastructure or the types of visitors found at the GYA parks. To the extent that the characteristics of these recreation sites or the people that visit them differ from those of the GYA, the value that respondents placed on them may differ from the value that motorized sightseers and cross-country skiers place on visiting the GYA.
- NPS used visitation statistics from the 2000–2001 season to compute a weighted average for the value of cross-country skiing and motorized sightseeing. If the 2000–2001 figures are not an accurate predictor of visitation shares during the coming winters, the weighted average surplus value will be biased upward or downward.
- In YNP most snowmobilers are concentrated in the area between West Yellowstone and Old Faithful. In contrast, automobile passengers, the largest group of non-snowmobilers, are confined to the northern portion of the park in winter. The majority of the costs of the delay rule may accrue to a small subset of non-snowmobilers, in which case the weighted average would need to be adjusted to reflect the activities of this subset.

# 4

## Small Entity Impact Analysis

The delay rule is expected to mitigate the overall impacts on small businesses during the winters of 2002–2003 and 2003–2004.

The proposed regulation potentially affects the economic welfare of a number of businesses, large and small. However, small entities may have special problems in complying with such regulations. The Regulatory Flexibility Act (RFA) of 1980, as amended in 1996, requires special consideration be given to these entities during the regulatory process.

To fulfill these requirements, agencies must perform a review to determine whether a proposed or final rule will have a significant economic impact on a substantial number of small entities. Based on the analysis prepared for the January 2001 rulemaking (NPS, 2001), NPS determined that the January 2001 rule would have a significant economic impact on a substantial number of small entities. The delay rule will mitigate these impacts during the winters of 2002–2003 and 2003–2004.

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### 4.1 ASSESSMENT

After considering the economic impacts of the delay rule on small entities, NPS concludes the delay rule will mitigate the impacts on most small businesses during the winters of 2002–2003 and 2003–2004 relative to the impacts under the January 2001 rulemaking. In cases where the delay rule causes revenues to drop during these two seasons compared to immediate implementation of the January 2001 rule, NPS expects that the declines will be very small and that they will accrue to firms that stand to benefit from the January 2001 rule in subsequent years. NPS made this determination using RFA implementation guidance provided by other agencies (NMFS, 2000;

EPA, 1999b; SBA, 1998) and provides the following factual basis for this determination:

- NPS projects higher total levels of revenue for firms providing unguided snowmobile rentals in the winters of 2002–2003 and 2003–2004 under the delay rule. Revenues for firms providing guided snowmobile rentals are expected to be lower in 2002–2003 but higher in 2003–2004 due to the delay rule, with the positive change outweighing the negative change (see Tables 3-13 and 3-14).
- NPS projects lower levels of revenue for firms providing snowcoach tours in the winters of 2002–2003 and 2003–2004 under the delay rule (see Tables 3-13 and 3-14). However, most firms providing snowcoach tours in the GYA have diversified sources of revenue from other activities such as skiing, ranch stays, and snowmobile rentals. There is no evidence suggesting that snowcoach losses from the delay rule would be sufficiently high to significantly impact any small firm. In fact, in some cases, firms that offer both snowcoach and snowmobiling services may benefit from the delay rule as their snowmobile revenues rise.
- NPS projects higher levels of revenue for other businesses (including hotels, restaurants, grocery stores, gas stations, and souvenir shops) in the GYA under the delay rule during the winters of 2002–2003 and 2003–2004 compared to the January 2001 rule (see Tables 3-13 and 3-14).
- NPS lacks sufficient data to estimate the change in producer surplus to firms catering to cross-country skiers and other outdoor nonmotorized recreators under the delay rule. Since revenues from cross-country ski and snowshoe rental are very minor in comparison with other types of revenues from winter recreation in the GYA, it is assumed that all shops offering this service have diversified revenue sources akin to those of the snowcoach operators. Regarding guided cross-country tour operators, NPS assumes that the delay rule will have no impacts on producer surplus because such tours generally target areas of the parks where snowmobiling is not allowed.

### ***Uncertainty***

See Section 3 for a discussion of the uncertainties involving estimates of producer surplus changes.

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# **Appendix A: Social Benefits and Costs of Snowmobiling Restrictions**

The purpose of benefit-cost analysis is to evaluate the social welfare implications of a proposed action—in this case, the regulation of snowmobile use in national parks. That is, it assesses whether the action imposes costs on society (losses in social welfare) that are less than the benefits (gains in social welfare). The following sections provide a description of the range of social benefits and social costs that may result from snowmobiling restrictions, the ways in which these benefits and costs can be conceptualized and measured, and a discussion of the economics literature estimating the monetary value of these benefits.

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## **A.1 SOCIAL BENEFITS OF SNOWMOBILING RESTRICTIONS**

Snowmobiling in national parks may be associated with a number of negative impacts on environmental resources and ecosystems. One result of any negative impacts that occur is that they impose welfare losses on individuals who value the parks' environmental resources. The benefits of snowmobiling restrictions can therefore be thought of and measured as the reduction in these losses to society. In addition, snowmobiling may negatively affect society in ways that are not directly related to the environment; therefore, the benefits of snowmobiling restrictions must also include reductions in these nonenvironmental losses. Potential natural resource

impacts were discussed in detail in Section 2.7. Both broad categories of benefits—environmental and nonenvironmental—are discussed in more detail below.

### **A.1.1 Environmental Benefits**

The use of snowmobiles may have adverse impacts on the aesthetic qualities of the park, on human health, and on the park's ecosystems. The benefits associated with avoiding these impacts are described below.

#### ***Aesthetic Benefits***

Among the largest and most directly damaging impacts associated with snowmobile use in national parks are its effects on the aesthetic qualities of park air and specifically the park soundscape. The natural soundscape is considered a natural resource of the park, and NPS attempts to prevent or minimize unnatural sounds that adversely affect the natural soundscape. National parks are especially valued for their pristine and undisturbed environments, which are often experienced by visitors through natural vistas and through the relative absence of visible or audible human activity (NPS, 2000b). The improvement or preservation of these aesthetic qualities, either in the form of reduced noise pollution or improved visibility, is therefore a potentially important source of benefits from reducing snowmobile use.

**Noise Reduction.** Perhaps the most noticeable and intrusive aspect of snowmobiles is the level of sound they emit during normal operation. Section 2.7 discusses the potential for noise-related disamenities as a result of snowmobile use. Those who are most likely to benefit from reductions in snowmobile-related noise pollution in national parks are other park visitors and recreators, in particular those engaged in other winter recreational activities inside the park, such as cross-country skiers, snowshoers, snowcoach passengers, or winter hikers.

Several studies have shown that noise from motorized vehicles diminishes the recreational experience of other users. Jackson and Wong (1982) and others have specifically documented conflicts between cross-country skiers and snowmobilers; noise levels are an important contributor to this conflict (Irwin, 1973; Knopp and Tyger, 1973; Lucas, 1964; Stankey, 1973). Several other studies have



found similar types of disamenities associated with other forms of mechanized recreational activities or other “technology-related” noises in recreation areas (Beal, 1994; Ivy, Stewart, and Lue, 1992; Bury and Luckenbach, 1983; Baldwin, 1970; Bury, Wendling, and McCool, 1976; Dunn, 1970; Lucas and Stankey, 1974; O’Riordan, 1977; Sheridan, 1979; Wagar, 1977).

Relatively few studies have specifically estimated the (negative) value of noise externalities on other recreators. One exception is a recent analysis conducted by the Federal Aviation Administration (FAA) to estimate the benefits of a regulation to restrict commercial air tours in Grand Canyon National Park (GCNP) (FAA, 2000). Using visitor-day value estimates from existing studies ranging from \$37 to \$92 (for backcountry, river, and other users of the park), the analysis assumed that these visitor day values would be reduced in relation to the how much aircraft noise interfered with the enjoyment of GCNP. Information about how aircraft noise affected different recreators was provided by a separate survey study of GCNP visitors. The survey found, for example, that for backcountry visitors 21 percent were “slightly” affected and 2.5 percent were “extremely” affected by the aircraft noise. In the FAA analysis, visitor value-days were assumed to be reduced by 20 to 80 percent depending on the percentage of respondents who indicated that their enjoyment of the park was “slightly,” “moderately,” “very,” or “extremely” affected by the noise.

Another example of such a study is one that has examined the losses that personal watercraft (jet ski) users impose on other beach recreators (Komanoff and Shaw, 2000). This study assumed that an average beach day (per person) is worth between \$10 for a popular beach and \$30 for a secluded one and that each 10 dB increase in background noise decreases these values by 10 percent. Assuming also that each 1 dB noise level increment reduces the value of a beach day by 1 percent, the study found that beachgoers suffer an average loss in recreation value of between \$0.50 and \$7.40 per jet ski cluster (1.6 jet skis over the course of a day) per person per day.

These values from these two studies are not directly transferable to the case of snowmobiles; nevertheless, they provide a useful point of reference for gauging noise-related losses for other winter recreators.

Other evidence regarding the noise-related losses imposed by snowmobiles can be gleaned from studies that have examined the effects of congestion on recreation values. In these studies, congestion is often measured as the number of encounters with other recreators, which may be thought of as being roughly equivalent to hearing the sound of snowmobiling. For example, in a study of backcountry recreators in the Caribou-Speckled Mountain Wilderness in Maine, Michael and Reiling (1997) found that weekend visitors experienced losses of \$22.3 (in 1990 dollars) per visit if they encountered more groups than expected. An older study of winter recreators (cross-country skiers and mountaineers) in the High Peaks area of the Adirondack Mountains found that each unit increase in the number of expected encounters decreased individuals' recreation value (per trip willingness to pay [WTP]) by 14 percent (Menz and Mullen, 1981).

**Visibility Improvements.** Several studies by the NPS and others have demonstrated the importance of visual air quality for visitors' (and nonvisitors') enjoyment and appreciation of national parks. Emissions from snowmobiles in these parks are one of many potential (albeit, a relatively small) sources of these visibility impairments.

Several studies have investigated U.S. households' values for improvements in visibility at various national parks across the country. All of these studies have found a significant WTP by both users and nonusers for visibility improvements. A meta-analysis of visibility studies at national parks (Smith and Osborne, 1996) found values ranging from \$5.52 to \$111.24 (in 1990 dollars) per household per year for visibility improvements. The variation in these values arises largely due to differences in study methodology, study area, and the proportionate change in visibility being valued.

### **Human Health Benefits**

In addition to nitrogen oxides (NO<sub>x</sub>) and particulate matter (PM), snowmobile emissions typically contain a number of other pollutants. Restrictions on snowmobile use in national parks are expected to reduce harmful exposures to park visitors and workers, particularly for individuals who spend extended periods in high-use areas. The benefits of these restrictions can be expressed as the value of reductions in the incidence (i.e., the number of cases

avoided) of harmful health effects. As mentioned in Section 2.7, the total number of avoided health effects is not known; however, using information from a recent EPA study of the benefits of air pollution regulations (EPA, 1997), Table A-1 provides a summary of “unit” values for selected health effects. Based on a review and synthesis of several health valuation studies, these values represent best estimates of individuals’ average WTP to avoid a single case of the health effect. In the absence of more complete information on the total health benefits of reducing snowmobile use, these values provide a rough sense of the magnitude and relative size of the benefits associated with avoiding specific health effects that may result from acute exposures.

**Table A-1. Unit Values for Selected Health Effects**

Health Effect	Unit Value (mean estimate) (1999\$) <sup>a</sup>
Acute Bronchitis	\$57
Acute Asthma	\$41
Acute Respiratory Symptoms	\$23
Shortness of Breath (one day)	\$6.8

<sup>a</sup>All amounts inflated using the consumer price index available from the Bureau of Labor Statistics (<<http://146.142.4.24/cgi-bin/surveymost>>).

### **Ecosystem Protection Benefits**

As illustrated in Figure 3-6, snowmobile use can cause damage to park ecosystems through a variety of media and pathways. As described above, snowmobile use leads to increased noise and air pollutant emissions. Noise may disrupt wildlife use patterns and terrestrial habitat may be disturbed, particularly when snowmobiles trespass off of the designated trails into areas with sensitive habitat. In addition, emissions deposited in the snowpack may migrate into the park’s water resources and, if present in high enough concentrations, they may adversely affect aquatic ecosystems. To the extent that these types of damages to park ecosystems occur, their cumulative effect is to reduce the “ecological services” that these systems provide to individuals and households across the country. National park ecosystems are particularly valued for their unique biological, cultural, and geological resources and the recreational and other services they provide.

A vast majority of park visitors (i.e., users) experience and enjoy the natural systems of the park through a wide variety of recreational activities (wildlife viewing, hiking, skiing, as well as snowmobiling). However, even individuals who are not park visitors (i.e., nonusers) can benefit from the knowledge that park resources are being protected and preserved. These nonuse values can stem from the desire to ensure others' enjoyment (both current and future generations) or from a sense that these resources have some intrinsic value. Evidence of such nonuse values for the protection of unique species and ecosystems has been documented in numerous studies (see e.g., Pearce and Moran [1994] for a review of such studies). Restrictions on snowmobile use in national parks can therefore provide benefits to both users and nonusers in a number of ways by protecting the parks' ecological resources.

### **A.1.2 Nonenvironmental Benefits**

Restrictions on snowmobile use in national parks can also improve societal welfare in ways that are not directly related to environmental quality in and around the parks. These potential nonenvironmental benefits are described below.

#### ***Public Safety Benefits***

As with many forms of motorized recreation, snowmobiling can involve increased risks to personal safety, both for snowmobile users and for others. According to the Consumer Product Safety Commission, the most common types of injuries nationwide involve being thrown or flipped from a snowmobile or striking a stationary object (Rice, Alvanos, and Kenney, 2000). Excessive speed and/or alcohol use are often contributing factors to these incidents. Recent statistics have also shown that snowmobiling has grown to be the most common cause of avalanche fatalities in the United States (Colorado Avalanche Information Center, 2000).

Aggregate statistics for snowmobile accidents are not available, but, as one would expect, in parks such as Yellowstone National Park, where snowmobile use has increased over the last decade, the number of incidents has also increased. In fiscal year 1998, snowmobilers comprised 2 percent of the year's total visitation, but were involved in 9 percent of that year's motor vehicle accidents (NPS, 2002). From December through March 1995–2001, 154

individuals required emergency medical assistance related to snowmobile activities (NPS, 2002).

Restrictions on snowmobiles in national parks would certainly reduce the number of such incidents in the parks.<sup>1</sup> The primary beneficiaries would be the snowmobilers themselves, whose safety would be protected; however, these benefits may be implicitly accounted for in the consumer surplus changes (see Section A.2) that these recreators experience as a result of the restrictions.<sup>2</sup> Other winter recreators (nonsnowmobilers) might also benefit if they would otherwise be at risk of being involved in accidents with snowmobiles. In addition, snowmobile accidents can impose costs on the NPS and other state and local government agencies that are responsible for providing medical, rescue, and related assistance. Reductions in snowmobile accidents in national parks would therefore allow some of the resources devoted to these activities to be diverted to other publicly beneficial uses.

### **Avoided Infrastructure Costs**

Allowing snowmobiles in national parks requires the NPS to develop, maintain, and operate an infrastructure to support these activities. In particular, snowmobile trails must be designated, maintained, and monitored. The costs associated with these activities vary widely across parks, depending on the physical characteristics of the parks and the level of snowmobile use permitted.

By restricting snowmobile use, some of these infrastructure-related costs can be avoided or reduced. As a result, some of the resources devoted to these activities can also be diverted to other publicly beneficial uses.

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<sup>1</sup>The benefits of these reductions may be offset to some degree by increased snowmobile usage and accidents in areas outside the parks.

<sup>2</sup>To the extent that snowmobilers are aware of the safety risks they face, the potential losses to themselves from accidents should already be factored into their consumer surplus from snowmobiling. This implies that the safety benefits to these individuals from reducing snowmobile use are implicitly accounted for (i.e., deducted from) the consumer surplus losses to these recreators.

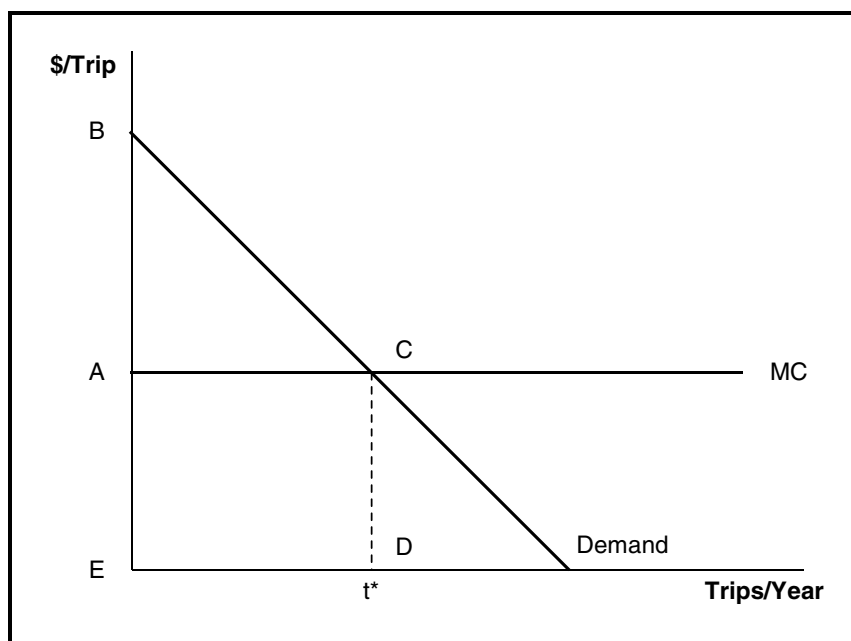
## A.2 SOCIAL COSTS OF SNOWMOBILING RESTRICTIONS

The primary losses associated with snowmobiling restrictions in national parks will accrue to:

- snowmobilers, in particular individuals who will not snowmobile in the park as a direct result of the restrictions, and
- providers of snowmobile-related services for park visitors.

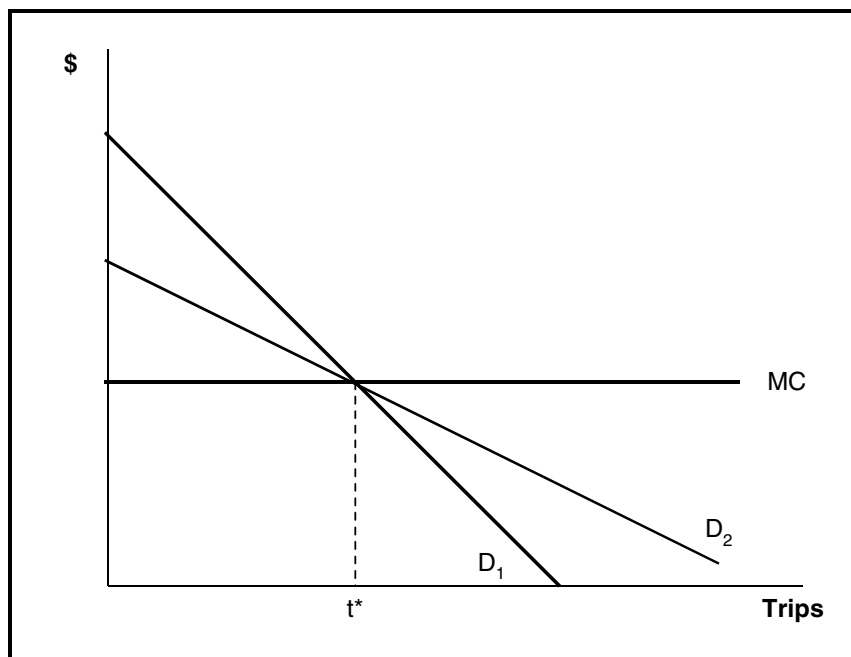
The welfare losses to individual consumers (snowmobile riders) are measured by their loss in consumer surplus. Consumer surplus is measured as the difference between the total cost of a product or activity to the consumer and the total amount the individual would be willing to pay for that activity. In the context of recreation activities, Figure A-1 depicts an individual demand curve for snowmobile trips, the marginal cost of a trip (MC, assumed to be constant), and the optimal number of trips per year,  $t^*$ . The triangle ABC measures the consumer surplus associated with this optimal number of trips—the difference between what the individual paid for the trips, ACDE, and the total WTP for the trips (the area underneath the demand curve), EBCD.

**Figure A-1. Consumer Surplus**



The extent of the welfare loss to an individual rider depends crucially on the availability of substitute activities. Figure A-2 depicts two alternative demand curves for snowmobile trips to a particular trail. The slope of the demand curve reflects the number of substitute activities available to a particular individual and the preferences of that individual toward those substitutes. The flatter demand curve,  $D_2$ , indicates that this individual has a variety of close substitutes for riding on the trail (these substitutes could include snowmobile riding on a different trail or participating in a different activity such as cross-country skiing). The individual with the steeper demand curve,  $D_1$ , has fewer substitute activities he/she enjoys as much as snowmobiling on this trail. If both individuals choose the same number of trips, as in Figure A-2, the person with the steeper demand curve,  $D_1$  (fewer substitutes for snowmobiling) receives greater consumer surplus from riding on the trail and thus will experience a greater loss in welfare if the trail is closed.

**Figure A-2. Consumer Surplus and Substitute Activities**

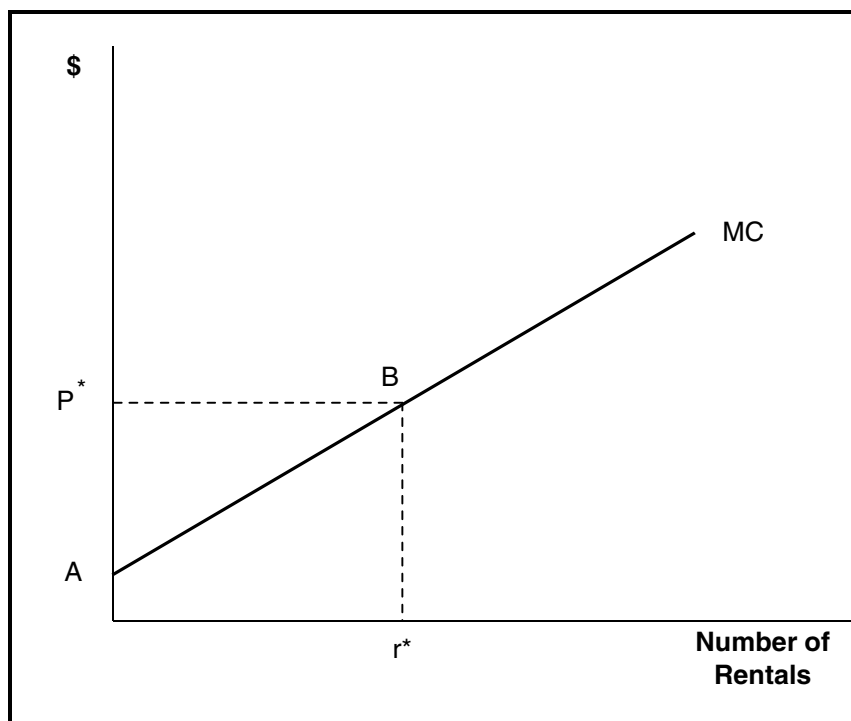


In addition to the study conducted in the Greater Yellowstone Area (GYA) by Duffield and Neher (2000), several additional studies that measure the consumer surplus associated with a day of snowmobile riding were identified. Walsh, Johnson, and McKean (1988) reviewed all types of outdoor recreation demand and found studies

of snowmobiling by Keith et al. (1978) and Keith (1980). A later meta-analysis produced by Rosenberger and Loomis (2000) reports the value from one additional study by May et al. (1997) in which the values come from her Master's thesis. Based on the May thesis findings, Coupal et al. (1999) present data from snowmobile owners in Wyoming. Using the travel cost method, they estimated the average consumer surplus associated with the riders' self-defined favorite areas. The regression accounted for the travel cost and quality of the next best area as defined by each respondent. From the regression, the authors generated an average consumer surplus value of \$68 per trip (in 1996 dollars). The authors calculated average consumer surplus per day by dividing the \$68 consumer surplus per trip by the average length of a trip in their sample (1.57 days). Average consumer surplus per day was \$43 (in 1996 dollars), but consumer surplus per day ranged from \$12 to \$49 for subsamples representing individuals with different motivations for snowmobiling.

The change in welfare for businesses is measured by producer surplus, or the area AP\*B in Figure A-3, where P\* is the market price of the good, e.g., a snowmobile rental. Producer surplus measures the difference between total revenue and the minimum revenue

**Figure A-3. Producer Surplus**





required for the firm to be willing to supply the product (integral of the area under the supply curve up to  $r'$ ). If the firms face an upward-sloping marginal cost (MC) curve, then a decrease in demand, indicated in Figure A-4 by a shift from  $D$  to  $D'$ , will result in lower producer surplus for snowmobile rental companies.

If snowmobile riding decreases as a result of the regulation, then the suppliers of snowmobile and other tourism-related services will be adversely affected, including rentals and sales of snowmobiles and snowmobile accessories, lodging, meals, and other tourism-related expenditures. If demand for other types of winter activities (e.g., cross-country skiing) increases, then some businesses may experience an offsetting increase in producer surplus.

**Figure A-4. Producer Surplus and a Change in Demand**

